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DEPARTMENT OF COMMERCE AND LABOR

BULLETIN
OF THE
BUREAU OF FISHERIES

VOL. XXVI

1906

GEORGE M. BOWERS, Commissioner

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[a] Date erroneously printed June 29 on cover of separate.

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FISHES OF THE ISLANDS OF LUZON AND PANAY.

By DAVID STARR JORDAN and ALVIN SEALE.

BUREAU OF FISHERIES DOCUMENT NO. 606.

FISHES OF THE ISLANDS OF LUZON AND PANAY.

By DAVID STARR JORDAN and ALVIN SEALE.

In the summer of 1900, in connection with the investigations in Japan by Professors Jordan and Snyder, a very considerable collection of fishes was made at Manila and Cavite, on the island of Luzon, and about Iloilo, on the island of Panay, in the Philippine Islands, by Dr. George A. Lung, surgeon in the United States Navy. This collection is the property of Stanford University, but a series of specimens has been presented to the U. S. Bureau of Fisheries and to the U. S. National Museum. The specimens in question are in excellent condition, and the large number of species obtained shows the faithful work of Dr. Lung as collector.

The following are the new species in the collection, with the numbers borne by the types and cotypes in the Stanford University and U. S. National museums. In cases where specimens are registered in both institutions the first number given is that of Stanford University, the second that of the National Museum. Where only one number is given, the Stanford University collection is referred to.

Jenkinsiella nectura (9984).
Gymnothorax philippinus (9215).
Doryichthys spaniaspis (9240).
Polydactylus zophomus (20113, 55598).
Amia cavitensis (9241).
Priopis lungi (9242, 53060).
Scolopsis luzonia (9243).
Upeneus luzonius (9244, 53067).
Abudefduf turchesius (9245).
Callyodon eleræ (9246).
Elates thompsoni (9247, 53068).
Rhinogobius lungi (9248, 53069).
Rhinogobius ocyurus (9249, 53070).
Gobius panayensis (9250).
Creisson validus (9251).
Oplopomus vergens (9256, 53071).
Blennius thysanius (9252, 53072).
Petroscirtes vulsus (9253).

Family CARCHARIDÆ.

SCOLIODON Müller & Henle.

1. Scoliodon acutus (Rüppell).

Two specimens from Cavite.

Family SPHYRNIDÆ.

SPHYRNA Rafinesque.

2. Sphyrna zygæna (Linnæus).

Length of posterior margin of each lateral expansion of the head equal to its width at eye; a groove along anterior edge of expansion. Three specimens from Cavite, length 11 to 17 inches.

Note.—The accompanying plates are from drawings by Mrs. Chloe Lesley Starks and William S. Atkinson.

Family RHINOBATIDÆ.

RHYNCHOBATUS Müller & Henle.

3. **Rhynchobatus djiddensis** (Forskål).

Dorsal almost over ventrals; a black spot behind eye; scattered round white spots over back. One specimen from Cavite, length 18 inches.

Family DASYATIDÆ.

DASYATIS Rafinesque.

4. **Dasyatis kuhli** (Müller & Henle).

Two specimens of this sting-ray are in the collection. The adult is brownish, with dark purple spots on back; the posterior half of tail has alternate white and dark bands. The young (in spirits) do not show the dark spots on back.

The specimens from Japan referred by Jordan & Fowler to *Dasyatis kuhli* do not belong to this species, but probably rather to *Dasyatis akajei*. *Dasyatis kuhli* is not certainly known to occur in Japan.

Family AETOBATIDÆ.

STOASODON Cantor.

5. **Stoasodon narinari** (Euphrasen).

One specimen of this ray was secured at Cavite. In spirits the color is brownish, the upper surface of disk covered with pale blue spots. The pale spots are much fainter than in Hawaiian examples, the latter, however, of much larger size.

Family CHIROCENTRIDÆ.

CHIROCENTRUS Cuvier.

6. **Chirocentrus dorab** (Forskål).

Head 5.50 in length; depth 6.75; eye 4.50 in head; dorsal 17; anal 33. Color silvery, blue on back, a dusky blotch on upper part of opercles. One specimen from Cavite, length 7.50 inches.

Family CHANIDÆ.

CHANOS Forskål.

7. **Chanos chanos** (Forskål).

Head 3.75 in length; depth 4.25; eye 3.05 in head; a very large adipose eyelid; dorsal 14; anal 9; scales 13–83–75. One specimen from Cavite, length 10.75 inches.

Family CLUPEIDÆ.

HARENGULA Cuvier & Valenciennes.

8. **Harengula gibbosa** (Bleeker).

Head 4 in length; depth 3.55; eye 3.10 in head; dorsal 18; anal 19; scales 42; bluish above, silvery below; belly sharply serrated; a dusky blotch on opercle; tip of dorsal and spot near base of anterior rays dusky; tip of caudal dusky. Seven specimens; length 1.50 to 4.25 inches.

This species is near *Harengula sundaica*, recorded by us from Negros. It is not quite so deep in body, and it usually shows some more or less distinct dusky streaks on upper third of body.

9. **Harengula moluccensis** (Bleeker).

Head 4.10 in length; depth 4.12; dorsal 18; anal 16; scales 45; eye 3 in head; maxillary ending under anterior third of eye; ventral below middle of dorsal. Color deep blue above, silvery below, the dividing line of colors sharply marked. Three specimens from Cavite, length 3.25 to 4.35 inches.

This species is near *H. sundaica*, but more slender in body.

DUSSUMIERIA Cuvier & Valenciennes.

10. **Dussumieria elopsoides** (Bleeker).

Head 3.80 in length; depth 5; eye 3.50 in head; dorsal 19; anal 15. Color bluish above, silvery below, a more or less distinct line along sides; margin of caudal dusky; belly not distinctly rounded but slightly compressed, with a ridge which, however, has no sharp scutes.

A second specimen has the head 3.50 in length; depth 6; eye 3.75 in head; dorsal 20; anal 24; scales about 56; some minute teeth in jaws. Color yellowish white, a distinct black streak down back, another indistinct one along side. The two colors are not sharply divided on sides. This specimen has the origin of ventrals under anterior half of dorsal.

Four specimens from Cavite; length 5.75 to 6 inches.

ILISHA Gray.

11. **Ilisha hœvenii** (Bleeker).

Head 3.50 in length; depth 9.45; eye 2.50 in head; dorsal 17; anal 37; maxillary 2 in head. Color silvery; tip of caudal and dorsal dusky. Eight specimens from Cavite, length 3 to 7.50 inches.

Family DOROSOMATIDÆ.

ANODONTOSTOMA Bleeker.

12. **Anodontostoma chacunda** (Hamilton).

Head 3.50 in length; depth 2.25; eye 3.50 in head; adipose eyelid well developed; tip of snout projecting beyond the narrow under jaw; maxillary ending under anterior margin of pupil; scales 39; dorsal 18; anal 19. Color light brown above, silvery below, a brown spot above axil of pectoral just posterior to upper edge of opercle. Five specimens from Cavite, length 3.50 to 6 inches.

Family ENGRAULIDÆ.

ANCHOVIA Jordan & Evermann.

13. **Anchovia commersoniana** (Lacépède).

Head 4.20 in length; depth 5.50; dorsal 15; anal 21; small teeth in jaws, vomer, and palatines; scales 36. Color yellowish white, caudal with wash of dusky at tip. Seven specimens from Manila, length 2 to 4.20 inches.

14. **Anchovia hamiltonii** (Gray).

Head 4.45 in length; depth 3.50; eye 4 in head; scales 40; dorsal 12; anal 37; maxillary ending as a sharp spine almost on line with posterior margin of opercle; maxillary 4.25 in head. Color brownish above; silvery below; red at base of anal; a blotch of short narrow black lines on shoulders; belly sharp, serrated. Two specimens from Cavite, length 3 and 7.35 inches.

15. **Anchovia indica** (Van Hasselt).

Head 4.50 in length; depth 6; eye 3.20 in head; dorsal 16; anal 18; scales about 40; deciduous teeth in jaws, vomer, and palatines. Color yellowish white; a silvery line on side. Six specimens from Cavite, length 2.50 to 6 inches.

Related to *Anchovia commersoniana*, but easily distinguished by the greater length and the greater number of scales.

Family SYNODONTIDÆ.

SAURIDA Cuvier & Valenciennes.

16. **Saurida japonica** (Houttuyn).

Head 4 in length; depth 9; eye 4.25 in head; dorsal 11; anal 10; scales 54; adipose eyelid thin. Color in spirits brownish above, with some indistinct blotches on side, white below; outer half of pectoral and caudal shaded with gray. Eight specimens from Cavite, length 3.50 to 5.50 inches.

This species differs from *Saurida badi* (Cuvier) in the thin adipose eyelid, and pale ventrals. *Saurida tumbil* has the scales 60, and the back with dark crossbars.

17. **Saurida gracilis** (Quoy & Gaimard).

Head 4.10 in length; depth 6.20; eye 5 in head; dorsal 10; anal 9; scales 49. Color brownish, with dusky blotches along the side, extending to below lateral line; fins spotted and irregularly banded with brown. Three specimens from Manila, length 4.25 inches.

Family LEPTOCEPHALIDÆ.

UROCONGER Kaup.

18. **Uroconger lepturus** (Richardson).

Teeth in double rows in jaws; vomerine teeth in a single pointed row; outer and anterior teeth largest. Tail tapering to a very fine point Color in spirits dull uniform brown; head and chin lighter. One specimen from Manila, length 12.50 inches.

Family MURÆNESOCIDÆ.

MURÆNESOX McClelland.

19. **Muræenesox cinereus** (Forskål).

Vomerine teeth large and sawlike, with a basal lobe before and behind. Two specimens from Manila, length 12.75 and 13.50 inches.

Family MYRIDÆ.

20. **Muræenichthys gymnopterus** (Bleeker).

Two specimens, one of 4 inches, one of 12, from Cavite.

Family OPHICHTHYIDÆ.

OPHICHTHUS Ahl.

21. **Ophichthus tapeinopterus** (Bleeker).

Teeth small, pointed, of equal size, forming broad bands in maxillary, in two rows on mandible and vomer; trunk half the length of tail; gape 2.75 in head. Color in spirits uniform yellowish brown, a little darker on upper part. One specimen from Cavite, length 11 inches.

22. **Ophichthus** sp. (larva).

Four specimens, from Manila, of a larval eel with sharp-pointed mouth, rather long teeth in a single series; no pectorals; anal, dorsal, and caudal fin differentiated, body very strongly compressed, rather short. Length 4 to 5 inches.

23. **Jenkinsiella nectura** Jordan, new species.

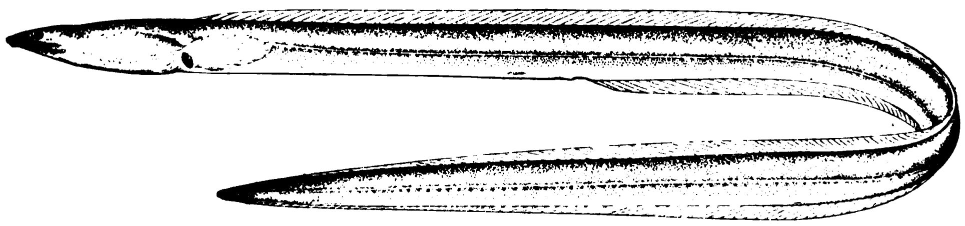

FIG. 1.—*Jenkinsiella nectura* Jordan, new species. Type.

Body slender, subterete, the greatest depth about 3 in head; head 9.75 in total length, 2.25 in trunk; head and trunk 3.5 in tail; eye very small, nearly 9 in head, 1.75 in snout; mouth rather large, extending much past eye nearly 3 in head; edge of upper lip with a row of conspicuous fleshy fringes posteriorly, the longest about

1.66 in eye; teeth slender, even, sharp, arranged in single series; no canines; upper jaw wider than lower and projecting around it; snout sharp, about 5.5 in head; anterior nostril with a moderate tube; gill openings small, placed rather low. Pectorals long, 1.6 in head; insertion of dorsal close behind base of pectoral. Dorsal fin very low, not much higher than eye. Anal very low; tip of tail without fin. Color light brown, darkened above by minute dots, which become sparse below; no distinct spots or bars; fins plain yellowish.

A single specimen, 7.5 inches long, was taken by Dr. Lung at Cavite. It is numbered 9984 in Stanford University.

The species is close to *Jenkinsiella macgregori* (*Microdonophis macgregori* Jenkins, Bull. U. S. Fish Commission XXII, 1902, p. 422) described by Jenkins from Maui, Hawaii. It differs from that species in the more posterior insertion of the dorsal, in the lower dorsal, and much longer pectoral. The coloration is much the same, but the tail is much longer in the Philippine species, *Jenkinsiella nectura*. The fringe of barbels, as in the genus *Cirrhimuræna*, well separates *Jenkinsiella* from *Microdonophis*.

Family MORINGUIDÆ.

24. **Moringua lumbricoidea** Richardson.

One specimen, 6.5 inches in length, from Cavite.

Family MURÆNIDÆ.

GYMNOTHORAX Bloch.

25. **Gymnothorax philippinus** Jordan & Seale, new species.

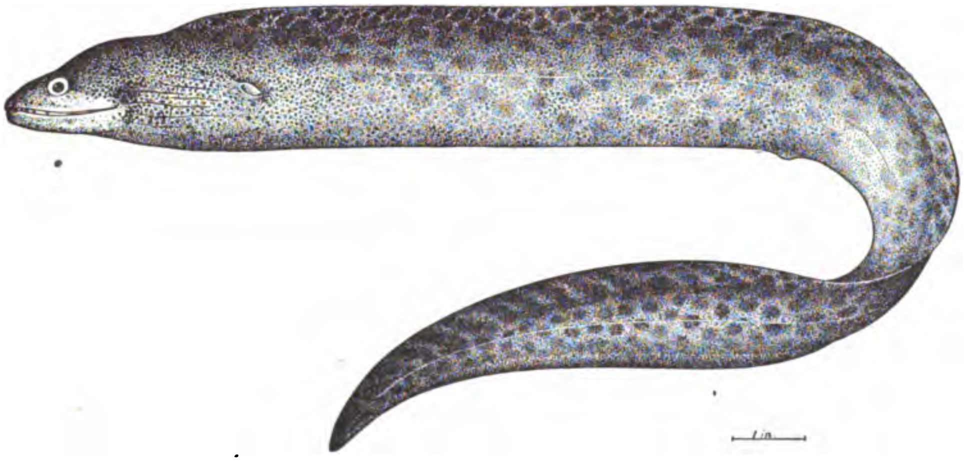

FIG. 2.—*Gymnothorax philippinus* Jordan & Seale, new species. Type.

Head 3.45 in trunk; length of head and trunk greater than length of tail by a distance equal to length of snout; eye rather large, 1.90 in snout; length of mouth to angle 2.40 in head; a single row of sharp-pointed teeth in lower jaw; teeth in upper jaw in a single row, reinforced by 3 or 4 additional teeth in palatine series; three large fang-like vomerine teeth in front, with a row of smaller ones extending back; anterior teeth large canines; fins of moderate height.

Color in spirits, everywhere powdered with yellow and brown, lighter on belly and chin, darker on posterior two-thirds of body, which shows rather wide indistinct darker bands; a distinct black blotch at angle of mouth, which unites with a black band around chin; a second dusky blotch midway between angle of mouth and gill opening; gill openings uncolored; fins dark, without white margins.

One fine specimen, the type, no. 9215, Museum Stanford University, 23 inches long.

Family SILURIDÆ.

NETUMA Bleeker.

26. Netuma nasuta (Bleeker).

Head 3.50 in length; depth 4.50; barbels 6; maxillary barbel single; dorsal I, 7; anal 17. Teeth villiform, those of palate in subtriangular patches, as in Bleeker's figure. Three specimens from Cavite, length 7 to 12 inches. In all of these specimens the spines have been broken off by the fishermen.

Family PLOTOSIDÆ.

PLOTOSUS Lacépède.

27. Plotosus anguillaris (Bloch).

Head 4.75 in length; depth 8; barbels 8. Color in spirits brown, with 2 longitudinal pale bands. Fourteen specimens from Manila, length 3 to 6.25 inches.

Family CLARIIDÆ.

CLARIAS Gronow.

28. Clarias magur (Hamilton-Buchanan).

Head 3.30 in length; depth 1.75; barbels 8; top of head entirely ossified except the small fontanelle. Dorsal 65; anal 53; pectoral spine finely serrated, hidden under the skin.

Family BELONIDÆ.

TYLOSURUS Cocco.

29. Tylosurus leiurus (Bleeker.)

Head 2.75 in length; depth 4.30 in snout; eye 2.75 in postorbital part of head; snout 4 in length without caudal. Dorsal 19; anal 23; insertion of dorsal over the eighth to ninth anal rays; caudal truncate; no teeth on vomer. Color in spirits bluish above, silvery below, a silvery and blue band along side; no keel on caudal peduncle. One specimen from Cavite, length 14 inches.

30. Tylosurus giganteus (Schlegel).

Head 2.30 in length; depth 3.30 in snout; eye 2.10 in postorbital part of head. Dorsal 24; anal 21; origin of dorsal very slightly posterior to origin of anal; caudal with lower lobe prolonged. Color in spirits bluish green above, silvery below, a blue line on side. Two specimens from Cavite, length 11.75 inches.

Family EXOCŒTIDÆ.

HEMIRAMPHUS Cuvier.

31. Hemiramphus quoyi Cuvier & Valenciennes.

Head 4.75 in length; exposed lower jaw 1.50 in head; depth 8.50; dorsal 16; anal 15; scales about 52. Color in spirits bluish above, a blue line on side; top of dorsal and tip of caudal bluish. Seven specimens from Cavite, length 4 to 8.75 inches.

32. Hemiramphus cantoris Bleeker.

Head 5 in length; exposed lower jaw 2.75; depth 6.50; dorsal 15; anal 15; caudal forked. Color in spirits yellowish white, side with a wide blue band; tip of caudal dusky; lower jaw and top of head dusky. Four specimens from Cavite, length 4 to 5.50 inches.

ZENARCHOPTERUS Gill.

33. Zenarchopterus dispar (Cuvier & Valenciennes).

Hemirhamphus dispar Günther, Cat., vi, 274.

Head 3.50 in length; the exposed lower jaw 2.50 in length without caudal; caudal almost rounded; scales about 39; base of anal modified into a reproductive organ; dorsal 11; anal 10. Color in spirits yellowish, with wash of light brownish; side with a silvery line, with a narrow dark line above it. One specimen from Cavite, length 4 inches.

PAREXOCŒTUS Bleeker.

34. Parexocœtus mento (Cuvier & Valenciennes).

Exocœtus mento Günther, Cat., vi, 281.

Head 4 in length; depth 5; eye 2.75 in head; dorsal 11; anal 12; ventrals short. Color in spirits bluish above, silvery below; pectoral bluish above, whitish below; dorsal with broad dusky tip. Eight specimens from Cavite; length 3.50 to 4.75 inches.

CYPSILURUS Swainson.

35. Cypsilurus brachysomus (Bleeker).

Head 4 in length; depth 5; eye 3 in head; dorsal 12; anal 8; ventral extending to middle of base of anal; pectoral reaching middle of base of dorsal. Color in spirits bluish above, silvery below; pectoral uniform bluish, the lower ray whitish. One specimen 7 inches long from Cavite.

Family FISTULARIIDÆ.

FISTULARIA Linnæus.

36. Fistularia serrata Cuvier.

Four young specimens from Cavite.

37. Fistularia petimba Lacépède.

One fine adult from Cavite, length 32 inches.

Family CENTRISCIDÆ.

CENTRISCUS Linnæus.

38. Centriscus scutatus Linnæus.

Head 3 in length; depth 2.10 in the projecting snout; dorsal iii, 10; anal 12; dermal skeleton with the ventral margin sharp. Nine specimens from Manila, length 3 to 3.20 inches.

Family SYNGNATHIDÆ.

CORYTHROICHTHYS Kaup.

39. Corythroichthys spicifer (Kaup).

Head 7.15 in length; snout 1.85 in head; rings 15+39; dorsal 26; a single ridge across cheek. Color in spirits brownish, with black bands around belly, a row of black dots on side of lower jaw. One specimen, length 6 inches, from Manila, and one 4.50 inches long from Cavite.

DORYICHTHYS Kaup.

40. **Doryichthys spaniaspis** Jordan & Seale, new species.

Head 8.75 in total length; snout 2.30 in head; rings 13+34; dorsal 20; no distinct filaments on head; cheek with a single keel; dorsal fin on 5 rings; profile about eye not elevated; snout narrow, its width being 1.50 in depth; trunk 1.75 in tail; egg-sac on abdomen; lateral line running down to caudal ridge, where it is interrupted; caudal small, its length 3.90 in head; pectoral of 14 rays, short, 5.50 in head; edges of rings not distinctly serrated; no strong median line on interorbital space. Color in spirits grayish with tint of green; alternating darker bands over body, narrow dusky crossbands of dots on chin and throat. One specimen from Cavite, the type, no. 9240, Museum Stanford University, 4.24 inches long.

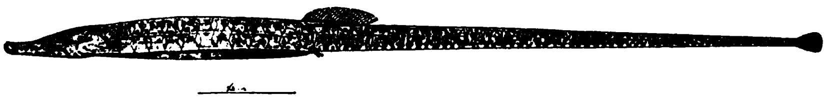

FIG. 3.—*Doryichthys spaniaspis* Jordan & Seale, new species. Type.

GASTEROTOKEUS Heckel.

41. **Gasterotokeus biaculeatus** (Bloch).

Head 5.25 in length; snout 1.85 in head; dorsal 44; rings 17+44; filaments on under side of body and tail. Color in spirits grayish, with slight tint of green; a row of black spots on each side of belly. Two specimens from Iloilo, length 5.75 and 6.25 inches. One specimen from Cavite, length 6.25 inches.

HIPPOCAMPUS Linnæus.

42. **Hippocampus aterrimus** Jordan & Snyder.

Hippocampus aterrimus Jordan & Snyder, Proc. U. S. National Museum, vol. XXIV, 1902, p. 14, pl. IX, Riukiu Islands.

Snout equal to postorbital part of head; spines blunt, short; dorsal 16; rings 11+36. Color black, spines enlarged at ventrals. One specimen from Cavite, agreeing with the Riukiu Islands type, length about 5 inches.

43. **Hippocampus kuda** Bleeker.

Snout longer than postorbital part of head; rings 11+35; dorsal 17; spines blunt. Color in spirits, brownish. One specimen from Cavite, length 5.50 inches. It corresponds well with the account given by Jordan and Snyder.

Family PEGASIDÆ.

PARAPEGASUS Duméril.

44. **Parapegasus natans** (Linnæus).

Head 3 in length; depth 13; snout 4.75 in head; dorsal 5; anal 5; vent much nearer eye than to base of caudal; tail compressed, with 12 rings; upper surface of head and trunk concave; pectoral rays equally slender; snout prolonged into a large flat process which is denticulate on sides; pectoral and dorsal spotted with brown. One specimen from Cavite, length 2.20 inches.

The generic name *Zalises* is synonymous with *Pegasus*.

Family MUGILIDÆ.

MUGIL Linnæus.

45. **Mugil longimanus** Günther.

Head 4 in length; depth 3.75; scales 32, 9 in vertical series; dorsal IV, 8; anal III, 8. Color in spirits silvery, with narrow indistinct longitudinal lines along each row of scales; a black spot at axil of pectoral. Five specimens from Cavite, length 4 to 7.50 inches.

46. **Mugil sundanensis** Bleeker.

Head 4.10 in length; depth 4; dorsal IV, 9; anal III, 9; scales 27 to 30, 9 in vertical series; a well-developed adipose eyelid; snout equal to eye; 17 or 18 scales in front of dorsal. Color in spirits silvery; no spot at axil; narrow line indistinctly along each row of scales. Two specimens from Cavite, length 7.50 inches.

47. **Mugil ceramensis** Cuvier & Valenciennes.

Six specimens from Cavite.

LIZA Jordan & Swain.

48. **Liza amarula** (Cuvier & Valenciennes).

Head 3.75 in length; depth 4; eye 3.10 in head; dorsal IV–I, 9; anal III, 9; scales 37; upper jaw rather wide, smooth; lower jaw thin, the symphysis prominent; preorbital strongly bent and serrated. Color silvery, light below, outer margin of caudal dusky. One specimen from Cavite, length 3.25 inches.

49. **Liza troscheli** (Bleeker).

Head 3.50 in length; depth 3.55; eye 3.50 in head, 1 in snout; scales 32, 11 in vertical series; no adipose eyelid; dorsal IV–I, 8; anal III, 9; 19 rows of scales before dorsal; lip thin; premaxillary hidden, except tip; preorbital strongly spinous at end; maxillary scaled; origin of dorsal over anterior third of anal; caudal emarginate. Color in spirits silvery, a light brownish wash above; caudal with dusky wash at margin, fins otherwise uniform. One specimen from Cavite, length 2.75 inches.

50. **Liza waigiensis** (Quoy & Gaimard).

Head 3.50 in length; depth 3.75; dorsal IV–I, 8; anal III, 8; scales 27. Color in spirits yellowish, with silvery reflections, the centers of scales with narrow dark longitudinal line; dorsals and upper half of pectoral black, other fins gray. Two young examples from Cavite, length 2.50 inches.

Family SPHYRÆNIDÆ.

SPHYRÆNA Linnæus.

51. **Sphyræna obtusata** Cuvier & Valenciennes.

Head 3 in length; depth 6.05; eye 4.25 in head; snout 2.50; dorsal VI, 9; anal I, 9; scales 83, about 16 series in front of dorsal and 16 between the 2 dorsals. Color in spirits dusky above, silvery below, an indistinct dusky band on side. Five specimens from Cavite, length 5 to 9.50 inches.

52. **Sphyræna jello** Cuvier & Valenciennes.

Head 2.90 in length; depth 8; scales about 130; dorsal V–I, 9; anal I, 9. Color in spirits yellowish, with indistinct darker bands over back and on sides. One specimen from Manila, length 5.25 inches.

Family POLYNEMIDÆ.

POLYDACTYLUS Lacépède.

53. **Polydactylus zophomus** Jordan & McGregor, new species.

Polynemus plebejus Cantor, Malayan Fishes, 27, 1854, Malayan Peninsula; not of Broussonet. Günther, Cat., II, 329, 1860; Amboyna; Malayan Peninsula; not synonymy.

Polydactylus plebeius Jordan & Evermann, Proc. U. S. Nat. Mus., XXV, 1902, 351, Kotosho, Formosa.

Head 3.2 in length to base of caudal; depth 3.25; dorsal VIII–I, 13; anal III, 13; first dorsal spine and first anal spine minute; 5 free pectoral rays, the longest reaching a little beyond tip of pectoral fin; eye 4 in head; scales large, ctenoid, deciduous, about 58 in lateral line.

Color in alcohol light golden brown; fins browner, all of them more or less speckled with black; first dorsal most heavily speckled and with a narrow but distinct black border; a horizontally oblong black spot with serrate edges, three-eighths of an inch in diameter, above gill-opening, the lateral line passing through its middle.

Four specimens, 0.25 to 8 inches in length, from Cavite, Luzon. The type is numbered 55598, U. S. National Museum. Cotype is no. 20113, Museum Stanford University.

This species differs from the true *Polydactylus plebeius* of Samoa in its much larger scales and also in its different color, its less concave anal and second dorsal, its deeper body, and shorter, blunter snout. In *P. zophomus* the free pectoral filaments reach but little beyond tip of pectoral, while in *P. plebeius* they reach beyond tip of ventral.

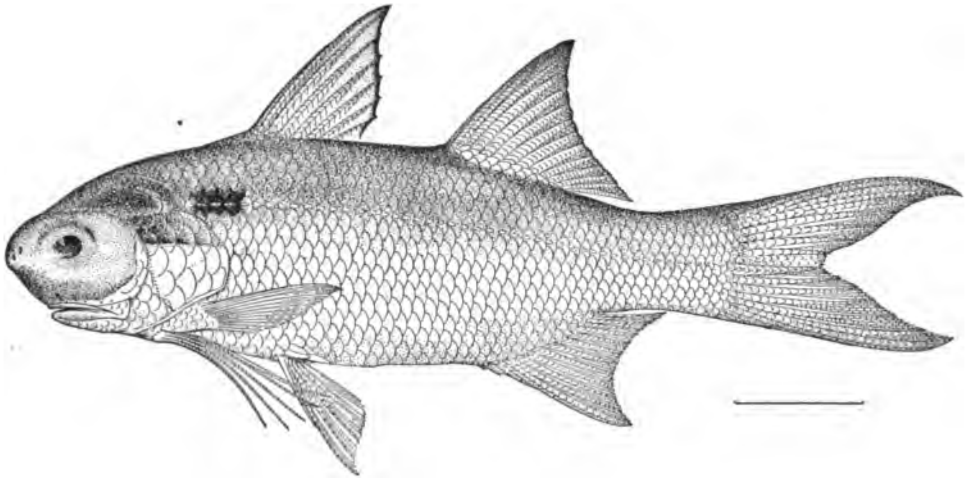

FIG. 4.—*Polydactylus zophomus* Jordan & Seale, new species. Type.

P. zophomus has been confounded with *Polydactylus plebeius*, as the above synonymy indicates. It is, however, quite distinct from the latter and equally so from the common Japanese species, *Polydactylus agonasi* Jordan & McGregor, which also has been recorded as *Polydactylus plebeius*.

Family HOLOCENTRIDÆ.

HOLOCENTRUS Bloch.

54. Holocentrus ruber (Forskål).

Head 2.75 in length; depth 2.75; dorsal XII, 13; anal IV, 9; scales 37. Color in spirits yellowish, with 8 dark longitudinal stripes; a dusky blotch at base of soft dorsal; tip of ventrals and upper and lower margins of caudal, web between first and second anal rays, and portions of spinous dorsal dusky. Three specimens from island of Panay, length 3 to 3.25 inches.

Family SCOMBRIDÆ.

SCOMBER Linnæus.

55. Scomber microlepidotus Rüppell.

Head 3.35 in length; depth 3.75; eye 3.90 in head; adipose eyelid covering all but middle of eye. Dorsal X–I, II, V; anal I, II–V; teeth minute, in both jaws; none on vomer or palatines; maxillary reaching to below posterior margin of eye. Color, back bluish, old individuals with longitudinal stripes, silvery below; young with dusky spot under pectoral fin; adults usually showing some dusky spots at base of spinous dorsal, the fin with dusky margins; other fins yellowish white; pectoral with slight wash of dusky at tip. Twelve specimens from Cavite, length 3 to 11 inches.

SCOMBEROMORUS Lacépède.

56. **Scomberomorus commersoni** (Lacépède).

Head 3.75 in length; depth 5; eye 4.75 in head; dorsal xvi–iii, 14+ix; anal ii, 12+ix; maxillary long, extending to posterior margin of eye; teeth strong, canine-like. Color bluish above, with irregular vertical bands, silvery below; first dorsal black, posterior dorsal with a black margin. One young example from Cavite, length 4 inches.

Family TRICHIURIDÆ.

TRICHIURUS Linnæus.

57. **Trichiurus savala** Bleeker.

Head about 7 in length; depth 2 in head; eye 5.50 in head, 2 in snout; jaws with long fang-like teeth; anal fin consisting of small spinules. Color silvery, slightly darker above; fins with slight dusky tint at tip. Six specimens from Cavite, length 10 to 17 inches.

Family CARANGIDÆ.

SCOMBEROIDES Lacépède.

58. **Scomberoides tala** (Cuvier & Valenciennes).

Head 4.50 in length; depth 3; eye 3.75 in head; dorsal vii–i, 20; anal ii–i, 17; teeth on jaws, vomer, tongue, and palatines; enlarged canines in each jaw; maxillary long, ending slightly posterior to hind-margin, of eye. Color in spirits dull bluish above, silvery below; a row of about 7 large vertical brown blotches along side; tip of dorsal dusky; a small black spot in axil of pectoral. Five specimens from Cavite, length 4 to 12 inches.

This species is easily distinguished from *Scomberoides toloo-parah* by its great depth and by its markings and from *S. lysan* by the presence of canines.

59. **Scomberoides toloo-parah** (Rüppell).

Head 4.50 in length; depth 4; eye 4.10 in head; dorsal v–ii, 18+ix; anal ii, 20, the posterior 10 or 12 anal rays united by a very narrow membrane at base only. Maxillary ending under posterior third of eye; minute teeth on jaws, vomer, palatines, and tongue, enlarged canine-like teeth in outer row in jaws; dorsal spines not connected. Color bluish above, silvery below; 8 or 9 dusky spots along side, a black spot at axil and a wide dusky area from upper margin of opercle to interorbital; anal fins golden; dorsal yellowish, with a black blotch on its upper half; tips of caudal slightly dusky; other fins yellowish white. Fourteen specimens from Cavite, length 4 to 10 inches.

TRACHUROPS Gill.

60. **Trachurops crumenophthalma** (Bloch).

Head 3.20 in length; depth 3.20; eye 2.75 in head; dorsal viii–i, 24; anal ii–i, 21; entirely scaled, scales of straight portion of lateral line forming keeled plates, about 38 in number. Color yellowish white, with golden reflections; a dusky opercular spot; caudal with dusky tip. Two specimens from Cavite, length 10 inches.

CARANX Lacépède.

61. **Caranx hasselti** Cuvier & Valenciennes.

Head 3.50 in length; depth 3.10; dorsal vii, i, 25; anal ii, 21; plates well developed; maxillary short, ending under anterior third of eye; pectoral very long, falcate, 2.75 in length. Color brownish above, silvery below; a very distinct opercular spot. One specimen from Cavite, length 7.50 inches.

62. **Caranx forsteri** Cuvier & Valenciennes.

Three specimens from Cavite.

63. **Caranx sexfasciatus** Quoy & Gaimard.

Head 3.10 in length; depth 2.75; eye 3.75 in head; adipose eyelid well developed; maxillary 2 in head, the end under posterior third of eye; teeth on jaws, vomer, palatines, and tongue; a row of slightly enlarged teeth in jaws; breast scaled; 53 scales in curved portion of lateral line; 34 plates along straight portion; dorsal VI–I, 20; anal II–17. Color yellowish; tip of dorsal, anal, and caudal dusky; a dusky wash along plates; axil dusky; a black opercular spot. Three specimens from Cavite, length about 11 inches.

These specimens seem to belong to the species from Hawaii and Samoa called *Caranx rhabdotus* by Dr. Jenkins.

64. **Caranx nigripinnis** Day.

Head 3.60 in length; depth 2.75; dorsal VII–23; anal II, 21; plates 54; breast scaled; no teeth on vomer or palatines. Color silvery below, dark bluish above; a distinct opercular spot; spinous dorsal dusky, soft dorsal more or less marked with dusky. Eight specimens from Cavite, length 3 to 4 inches.

65. **Caranx ignobilis** (Forskål).

Head 3.50 in length; depth 2.50; eye 3 in head; maxillary reaching to below posterior third of eye; no scales on breast; dorsal VI–I, 20; anal II–1, 18. Color silvery, darker above, with 5 wide vertical dusky bars. Eleven specimens from Cavite, length 1.50 to 3.75 inches.

66. **Caranx speciosus** (Forskål).

Color silvery, with about 11 dusky lines alternating narrow and wide, the one through the eye and the one over nuchal region very dark. Two specimens from Cavite.

67. **Caranx plumbeus** Quoy & Gaimard.

Head 3.20 in length; depth 2; eye 3.75 in head; dorsal VI–I, 21; anal II–I, 18; maxillary 2.18 in head; 42 plates along lateral line; axil black; several of dorsal and anal rays elongate and filiform in males. Color yellowish, with bright reflections; the young banded vertically, with anterior rays of dorsal and anal extremely elongate; in females, a dusky blotch on posterior margin of opercle. Eight specimens, length 3.50 to 10 inches.

This species seems identical with the one from Samoa which we call *Caranx plumbeus.*

68. **Caranx armatus** (Forskål).

Head 3 in length; depth 1.50; eye 3.10 in head; small teeth on jaws, vomer, and palatines; maxillary extending to below anterior margin of pupil; breast naked; a dusky opercular spot; dorsal VI–I, 20; anal II–I, 18; about 48 scales in straight portion of lateral line; the anterior rays of dorsal and anal elongate. Three specimens from Cavite, length 2 to 3 inches.

ALECTIS Rafinesque.

69. **Alectis ciliaris** (Bloch).

Head 2.75 in length; depth 1.20; eye 4 in head; dorsal VI–I, 19; anal II–I, 16; teeth villiform. A small keel on side of caudal peduncle; anterior dorsal and anal rays greatly prolonged into black filaments; anterior rays of ventrals greatly prolonged; five wide, rather indistinct bands down the side. Three specimens from Cavite.

Family RACHYCENTRIDÆ.

RACHYCENTRON Kaup.

70. **Rachycentron pondicerrianum** (Cuvier & Valenciennes).

Head 4 in length; depth 7.50; dorsal VIII–30; anal 27. Villiform teeth on jaws, vomer, palatines, and tongue. The young have the caudal rounded; in the adult it becomes lunate. Color in spirits brownish; two brown longitudinal lines along side; upper and lower margins of caudal white. Two specimens from Iloilo, length 4.15 and 6.75; one specimen from Manila, length 8.5 inches.

Family MENIDÆ.

MENE Lacépède.

71. **Mene maculata** (Bloch).

Head 3.10 in length; depth 1.18; eye 3.20 in head; dorsal IV, 42; anal 33; no scales; origin of dorsal fin on back; teeth villiform. Color silvery below, with large bluish blotches above a line from pectoral to top of caudal peduncle; a dusky spot in front of eye. The young have the ventral fins filiform. Three specimens from Iloilo; length 2 to 7.50 inches.

Family EQUULIDÆ.

EQUULA Cuvier.

72. **Equula insidiator** (Bloch).

Head 3.75 in length; depth 2.10; eye 2.26 in head. Color yellowish white, with several incomplete bands over back, down to middle of side; a black band from lower anterior orbital margin to chin. Four specimens from Cavite, length about 3.25 inches.

73. **Equula ruconia** (Hamilton-Buchanan).

Equula interrupta Günther, Cat., II, 504. Day, Fishes of India, 242, pl. LI, c, fig. 4.

Head 3.75 in length; depth 1.50; eye 2.50 in head; dorsal VIII, 16; anal III, 14; lateral line extending to opposite middle of soft dorsal. Color yellowish above, silvery below; axil of pectoral black; a black line from orbit to chin; a dusky spot on upper part of opercle; dorsal tipt with dusky. Five specimens from Cavite, length 2 to 2.75 inches.

This species is very similar to *Equula insidiator*, but the body is deeper.

LEIOGNATHUS Lacépède.

74. **Leiognathus fasciatus** Lacépède.

Head 3.20 in length; depth 2; eye 2.60 in head; dorsal VII, 16; anal III, 14; lateral line complete; lower margin of preopercle finely denticulate; teeth minute, two minute spines above upper anterior margin of orbit; second dorsal and second anal spines greatly elongate, the third and fourth dorsal spines rugose on sides. Color silvery, with indications of irregular vertical streaks on body. One specimen from Cavite, length 4.12 inches.

75. **Leiognathus dussumieri** (Cuvier & Valenciennes).

Head 3 in length; depth 1.60; eye 3 in head; dorsal VIII, 16; anal III, 14; lateral line complete; two small spines above anterior margin of eye; teeth villiform; thorax naked. Color silvery, bluish above; axil of pectoral black. Two specimens from Cavite, length 2 and 7 inches.

GAZZA Rüppell.

76. **Gazza minuta** (Bloch).

Head 3 in length; depth 2; eye 3 in head; dorsal VIII, 16; anal III, 14. Color silvery bluish above, a slight yellowish wash above the head, a dusky spot in axil; iris yellow. Eight specimens from Cavite, length 4 to 5.50 inches.

Family STROMATEIDÆ.

APOLECTUS Cuvier & Valencienne

77. **Apolectus niger** (Bloch).

Head 2.75 in length; depth 1.75; eye 3.30 in head; dorsal VI, 42; anal 37; 5 or 6 rudimentary spines in front of dorsal; minute teeth in jaws, apparently none on vomer or palatines; scales minute, breast apparently naked; scales of lateral line very slightly modified into feeble plates on caudal peduncle. Color grayish brown; dorsal and anal bluish; young with about 4 indistinct vertical bluish bands, a dusky ocular band.

A specimen 2.75 inches long has ventral fins 0.75 of an inch long, while a larger specimen, length 3.75 inches, has the ventrals but 0.30 of an inch long; these fins disappear in the adult.

Two specimens (young) from Cavite.

Family APOGONICHTHYIDÆ.

AMIA Gronow.

78. **Amia quadrifasciata** (Cuvier & Valenciennes).

Head 2.75 in length; depth 3; eye 3.75 in head; dorsal vii–i, 9; anal ii, 8; scales 25. Color in spirits yellowish, with 2 longitudinal brown stripes, one from tip of snout thru eye and along median line of body to tip of caudal, the other from upper part of snout back to base or near base of caudal; about 11 indistinct vertical bands on side of body; a black band through the basal portion of soft dorsal and anal; anterior part of spinous dorsal marked with dusky; tip of ventrals dusky; anal also indistinctly tipped with dusky; no black spot at base of caudal. Six specimens from Cavite, length 2.50 to 3 inches. Three of these, which differ in no other respect, have the colors much less distinct, not showing any trace of the vertical bands, and a very indistinct trace of bands through anal and dorsal.

Amia fasciata (White), from Sydney, as represented by specimens sent by Mr. Edgar R. Waite, seems to be distinct from this species, and equally so from *Amia novemfasciata* (Cuvier & Valenciennes) and *Amia aroubiensis* (Hombron & Jacquinot), with both of which Dr. Günther confounds it in Fische der Südsee.

79. **Amia cavitensis** Jordan & Seale, new species.

Head 2.90 in length without caudal; depth 3.05; dorsal vii–i, 9; anal ii, 8; eye 3 in head; scales 2–26–5; maxillary 2 in head, its distal end under posterior third of eye; posterior limb of preopercle serrated; snout 1.35 in eye; interorbital equal to snout.

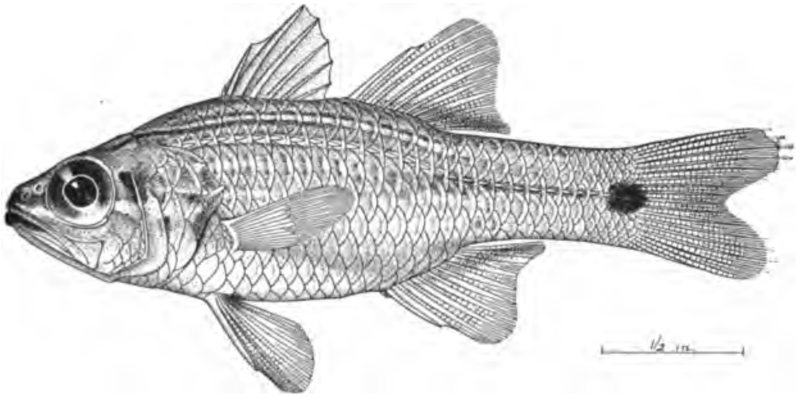

FIG. 5.—*Amia cavitensis* Jordan & Seale, new species. Type.

Body compressed, of moderate depth, the profile from origin of dorsal to tip of snout almost straight; depth of caudal peduncle 2.20 in head; small teeth on jaws, vomer, and palatines; lateral line complete; origin of spinous dorsal directly over origin of ventrals, third dorsal spine 1.90 in head; second less than half as long, the first very minute; the spine of soft dorsal 2.20 in head, the longest dorsal ray 1.50; base of anal 2.75 in head, longest ray of anal 1.75 in head; ventrals 1.75 in head; pectorals 1.50; caudal slightly emarginate, with lobes rounded.

Color in spirits yellowish, a distinct dusky line on median line of nuchal region; a distinct dusky line from snout over eye, extending to upper base of caudal, very indistinct posteriorly; a wide dusky line from snout thru eye to opercle; about 5 indistinct shadowy, longitudinal lines on side of body; tips of fins dusky; a distinct round spot on middle of base of caudal, dorsal fins yellowish, with slight wash of dusky more distinctly dusky on posterior rays of soft dorsal, other fins yellowish-white with slightly dusky wash, the anal with indistinct dusky line at base.

One specimen from Cavite, the type, 2.75 inches long, no. 9241, Museum Stanford University.

This species seems related to *A. hartzfeldii* (Bleeker).

80. **Amia novæ-guineæ** (Bleeker).

Head 2.50 in length; depth 3; eye 3.75 in head; dorsal VII–I, 9; anal II, 8; scales 25; lateral line complete; outer limb only of preopercle denticulate, and that very minutely; maxillary reaching to below posterior margin of pupil; teeth in jaws, vomer, and palatines. Color yellowish; anterior spines of spinous dorsal dusky, tip of soft dorsal dusky and a dusky line thru its lower third; caudal with dusky tip; other fins without markings. Three specimens, apparently young and faded, the smallest two showing an indistinct banded appearance; length 2.25 to 3.25 inches.

MIONORUS Krefft.

81. **Mionorus glaga** (Bleeker).

Head 2.45 in length; depth 2.75; eye 4.12 in head; dorsal VII–I, 9; anal II, 8; scales 27; maxillary 2 in head, its end under posterior margin of orbit. Color yellowish, with about 8 irregular dusky longitudinal stripes, no spot on caudal peduncle; upper half of spinous dorsal black; soft dorsal with about 4 irregular oblique dusky bands; caudal margined and tipped with dusky; anal with 2 or more dusky bands on basal half; ventrals and pectoral yellow. Four specimens from Cavite, length about 1.50 to 4 inches.

82. **Mionorus mydrus** Jordan & Seale.

One young example from Manila.

FOA Jordan & Evermann.

83. **Foa fo** Jordan & Seale.

Head 2.55 in length; depth 2.30; dorsal VII–I, 9; anal II, 8; scales 22; opercle and preopercle entire; lateral line strongly developed on anterior 9 scales, connected with a broken line of points on caudal peduncle; villiform teeth in jaws, vomer, and palatines; maxillary 2 in head, its distal end under posterior margin of eye. Color in spirits yellowish, with dark mottlings, ventrals dusky. Three specimens from Cavite, length 2 to 2.25 inches, identical with the original type from Samoa.

Foa differs from *Mionorus* in the incomplete lateral line.

ARCHAMIA Gill.

84. **Archamia lineolata** (Ehrenberg.)

(*Apogon lineolatus* Günther, Cat., I, p. 244.)

Head 2.50 in length; depth 2.25; eye 3.10 in head; maxillary 2, reaching to below posterior margin of pupil; scales 23; lateral line complete; cheek scaled, lower limb of preopercle only denticulate; teeth in jaws and on vomer, none on palatines; second dorsal spine 2.75 in depth; dorsal VI–I, 10; anal II, 17. Color in spirits yellowish white, slightly shaded with minute black dots which are largest and most abundant on cheek; fins unmarked; some have a spot at base of caudal and on opercle; others do not. Six specimens from Cavite, length 1.50 to 3.50 inches.

PSEUDAMIA Bleeker.

Pseudamia is apparently well distinguished by its small scales.

85. **Pseudamia polystigma** (Castelnau).

Apogonichthys polystigma, Bleeker, Atlas, pl. CCCXLVIII, fig. 2.

Head 2.75 in length; depth 4.12; eye 4.75 in head; dorsal VI–I, 8; anal II, 10; scales 42, a distinct membranous flap at each anterior nostril; maxillary reaching to below posterior margin of eye. Color grayish, each scale with dark specks which form irregular rows, a large black blotch on base of caudal; dorsal fins dusky, with submarginal area of deep black on soft dorsal; caudal blackish; anal dusky; ventrals yellowish; top of head black; a black dot on posterior maxillary. One specimen from Cavite, length 4.25 inches.

Family AMBASSIDÆ.

86. Ambassis kopsi (Bleeker).

Head 2.75 in length; depth 2.50; eye 2.75 in head; scales 30, two rows of scales on cheek; lateral line curved, continuous, 2½ rows of scales above it, 9 or 10 scales before dorsal; preorbital and lower limb of preopercle serrated; first dorsal spine 3.50 in length. Color yellowish white, uniform or with indistinct silvery line down middle of body; a black tip to second to fifth dorsal spines and membranes. Two specimens from Cavite, length 3 and 3.50 inches.

The generic name *Chanda* Hamilton-Buchanan, 1822, has priority over *Ambassis* Cuvier, 1828. The name *Ambassis* is not used in a generic sense by Commerson or by Lacépède. The first reviser of *Chanda*, Fowler (Proc. Ac. Nat. Sci. Phila. 1905, p. 500), has chosen *lala* as type, and as this is a species of the group called *Pseudambassis*, *Chanda* would replace the latter name, thus allowing *Ambassis* to stand for the original type, *Ambassis ambassis*.

PRIOPIS Kuhl & Van Hasselt.

87. Priopis buruensis (Bleeker).

Head 2.75 in length; depth 2.25; second dorsal spine 3.40; preorbital serrated; two rows of scales on cheek; lateral line interrupted; maxillary 2.75 in head, its tip under anterior margin of eye. Color yellowish white, slightly shaded above with minute dots, a silvery band along median line; membrane between third and fourth spines dusky, between third and fourth anal spines white. Two specimens from Cavite, length 3.25 and 4 inches.

88. Priopis interruptus (Bleeker).

Head 2.75 in length; depth 2.20; eye 2.75 in head; scales 26; second dorsal spine very strong, equal to head, scales on cheek in 2 rows of 5 scales each. Color yellowish white; membrane between second and third dorsal spines dusky; a dusky line on a silvery band from base of caudal forward, fading out under anterior of spinous dorsal. One specimen from Cavite, length 2.75 inches.

89. Priopis lungi Jordan & Seale, new species.

(*Ambassis urotænia*, Day, not of Bleeker.)

Head 2.75 in length without caudal; eye 2.85 in head; dorsal VII–I, 9; anal III, 9; scales 3–24–6; a single row of scales on cheek; snout 1.85 in eye; interorbital 1.50 in eye; lateral line interrupted under third dorsal ray and turned downward to middle of side, where it is continued to base of caudal; anterior portion with 14 pores, oblique portion one complete pore and one partial pore, posterior portion 12 pores.

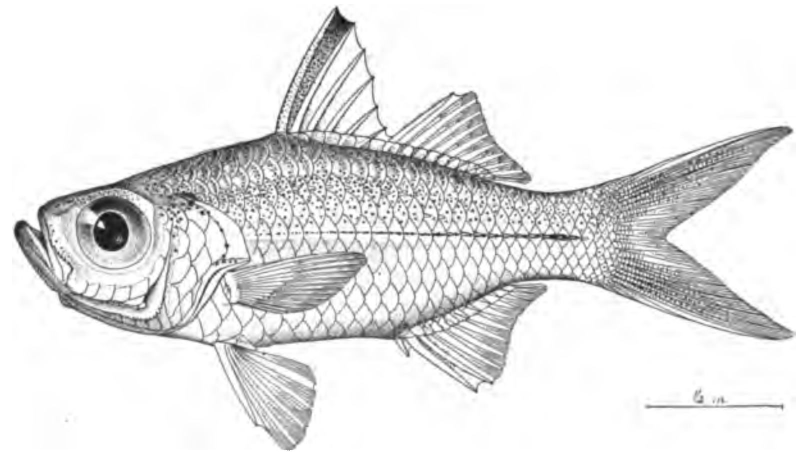

FIG. 6.—*Priopis lungi* Jordan & Seale, new species. Type.

Body moderately elongate, compressed; depth of caudal peduncle 2.50 in head; snout pointed, lower jaw the longer; upper anterior profile from origin of dorsal to tip of snout with a low angle and almost straight;

maxillary 2.85 in head; minute teeth on jaws, vomer, and tongue; preorbital and lower limbs of preopercle serrated; gillrakers rather long, sharp-pointed; second dorsal spine strong, 1.50 in head; spine of second dorsal 2.35; base of anal 1.90; third anal spine the longest, 2.10; pectoral 1.60; ventral 1.60, its origin directly below origin of pectoral; caudal deeply forked, its length greater than head.

Color in spirits yellowish white; a narrow dark line along median line of side, becoming more distinct posteriorly; a dark line along base of dorsal fins; membrane between second and third dorsal spines dusky; membrane between second and third anal spines slightly tinted with dusky; upper and lower margin of caudal white, the submarginal area dusky; a dusky blotch on upper part of orbit; eye golden.

Two specimens from Cavite. Type, no. 53060, U. S. National Museum, length 2.85 inches. Cotype, no. 9242, Museum Stanford University.

This species is characterized by the single row of scales on cheek, the broken lateral line, and by the marking of the fins. *Priopis urotænia* Bleeker, with which Day confounds this species, has a double row of scales on cheek.

Family SERRANIDÆ.

PLECTROPOMUS (Cuvier) Oken.

90. Plectropomus calcarifer (Bloch).

Head 2.60 in length; depth 3.20; eye 4.20 in head; dorsal vii–i, 12; anal iii, 9; scales 46 to base of caudal; preopercle serrated, with a strong spine at angle; opercle with a small flat spine; maxillary reaching to below posterior third of iris; minute teeth on jaws, vomer, palatines, and tongue; no canines. Color dusky brownish, with numerous indistinct longitudinal dusky stripes; fins brownish; tips of ventrals, anal, caudal, and soft dorsal with slight wash of dusky. One specimen from Cavite, length 5 inches.

The generic name *Plectropomus*, later called *Plectropoma*, belongs apparently to this species as the *chef de file* of Cuvier, *calcarifer*.

CEPHALOPHOLIS Bloch & Schneider.

91. Cephalopholis stigmatopomus (Richardson).

Head 2.50 in length; depth 2.75; eye 5 in head; dorsal ix, 15; anal iii, 8; scales about 187; teeth in several series in jaws, with 4 outer anterior canines in each jaw; small teeth on vomer and palatines; opercle with 3 strong spines, the upper the longest, the lower two closer together; preopercle with small denticulations; mouth long; maxillary 2 in head. Color uniform brown, becoming blackish posteriorly, fins black, unmarked. One specimen from Manila, length 7.50 inches.

CROMILEPTES Swainson.

92. Cromileptes altivelis (Cuvier & Valenciennes).

Head 2.75 in length; depth 2.75; eye 4 in head; dorsal x, 18; anal iii, 10; scales 136; teeth in jaws, vomer, and palatines; preopercle serrated and rounded; opercle with 3 spines, the middle one the largest. Color light brown, with scattered round deep black spots, about size of eye on fins and body, small on head, a few running together on belly. One specimen from Manila, length 4.50 inches.

EPINEPHELUS Bloch.

93. Epinephelus malabaricus Bloch.

Head 2.60 in length; depth 3; eye 4.75 in head; dorsal xi, 17; anal iii, 8; scales about 100 in lateral series; gillrakers 14; preopercle serrated, with about 3 of the teeth at angle enlarged; opercle with spines, the two lower ones nearer together than upper and middle, the middle one largest and most posterior; canines in anterior of jaw. Color dull brownish, apparently without stripes or markings. Two specimens from Cavite, length 3.75 and 4.50 inches.

94. Epinephelus diacanthus (Cuvier & Valenciennes).

Head 2.85 in length; depth 3.20; eye 5 in head, 1 in snout, and 1 in interorbital; preopercle serrated, the serrations larger at angle; dorsal xi, 16; anal iii, 8; scales about 100. Color brownish, with 6 dark bands over back, which slope obliquely forward; numerous vermiculating brownish lines with some spots on side of body; dark bands of body extending into dorsal fin. Fourteen specimens from Cavite, length 3 to 8 inches.

Two of these specimens have the eye much larger and the body slightly more elongate, and may prove to be a different species.

95. **Epinephelus megachir** (Richardson).

Head 2.30 in length; depth 3.10; eye 3.75 in head; preopercle serrated, the serrations larger at angle; dorsal XI, 16; anal III, 8; scales 85; 14 gillrakers. Body with extremely large brown spots which also cover the fins. One specimen from Cavite, length 5 inches.

96. **Ephinephelus tauvina** (Forskål).

Head 2.60 in length; depth 3; eye 5 in head; scales 110. Grayish dusky above, with 6 indistinct bands and scattered large brown spots; preopercle serrated, the serrations much larger at angle. Three specimens from Cavite, length about 5 inches.

Family PRIACANTHIDÆ

PRIACANTHUS Cuvier.

97. **Priacanthus cruentatus** (Lacépède).

Head 3 in length; depth 2.5; eye 2 in head; dorsal X, 12; anal III, 13; scales about 75; maxillary reaching to below anterior of pupil, 2 in head; preopercle serrated, with long spines at angle, the spine reaching to below middle of base of pectoral, tenth dorsal spine 2 in head, the ninth about as long. Color in spirits dull brown, margin of dorsal dusky, tips of ventrals dusky, also tip of caudal. Two specimens from Cavite, length 3 and 3.50 inches.

Family LUTIANIDÆ.

LUTIANUS Bloch.

98. **Lutianus dodecantheoides** (Bleeker).

Head 2.50 in length; depth 2.30; dorsal XI, 12; anal III, 9; scales 11-55; eye 4.75 in head; snout 2.75. Color in spirits yellowish white, with narrow oblique dusky lines above lateral line and about 10 longitudinal lines below; a silvery white blotch in posterior axil of dorsal; a broad black saddle over caudal peduncle; dorsal tipped with black; a dusky wash on anal; tips of ventrals black. One specimen from Manila, length 7 inches.

99. **Lutianus vitta** (Quoy & Gaimard).

Head 2.50 in length; depth 3; dorsal X, 13; anal III, 8; scales 11-66; eye 4.50 in head; snout 3.10. Color yellowish white, center of scales above lateral line with dark spots, forming dark oblique lines one-fourth as wide as interspaces, a broader brown band from eye along side to below posterior axil of soft dorsal; no color on fins; notch and knob of opercle small but distinct. Eighteen specimens from Cavite, length 3.25 to 9 inches.

100. **Lutianus quinquelineatus** (Cuvier & Valenciennes).

One specimen from Cavite. Five blue stripes along side; a large dusky lateral blotch.

101. **Lutianus russelli** (Bleeker).

Head 2.75 in length; depth 2.75; eye 3.50 in head; snout 3.50; dorsal X, 14; anal III, 8; scales about 47. Two young examples from Cavite, length 3 inches.

102. **Lutianus gibbus** (Forskål).

Head 2.75 in length; depth 2.75; eye 4 in head, 1.50 in snout; preopercular knob and notch large, acute; dorsal X, 14; anal III, 8; scales 8-65. Color yellowish white, with many (35 to 40) narrow oblique dusky lines following the oblique lines of scales entirely across the body. Spinous dorsal with dusky margin; soft dorsal dusky with white upper margin; ventrals tipped with dusky; anal with margin of white and intramarginal area of dusky; caudal dusky with white margin. One specimen, 7 inches long, from Cavite.

As compared with *Lutianus gibbus* of the same size from Samoa, the maxillary is shorter, the depth of body is less, and the snout is less pointed.

103. **Lutianus decussatus** (Cuvier & Valenciennes).

Head 2.75 in length; depth 3; dorsal x, 13; anal iii, 8; scales 7-65; snout 3 in head; eye 4.50 in head; maxillary 2.75, reaching to below anterior half of eye; no distinct preopercular notch. Color yellowish white, with 5 wide brown longitudinal bands on side, the 3 upper ones with 7 vertical bands extending through them; a black spot on caudal peduncle. One specimen from Manila, length 5.50 inches.

PINJALO Bleeker.

104. **Pinjalo typus** Bleeker.

Head 3 in length; depth 2.50; dorsal xi, 13; anal iii, 9; scales about 60; preopercle serrated; mouth moderate; maxillary ending under anterior margin of eye; teeth in jaws and vomer, none on palatines or tongue. Color uniform yellowish white, the dorsal fins with dusky edges, middle of caudal margin dusky Nine specimens from Cavite, length 2.75 to 5 inches.

NEMIPTERUS Swainson.

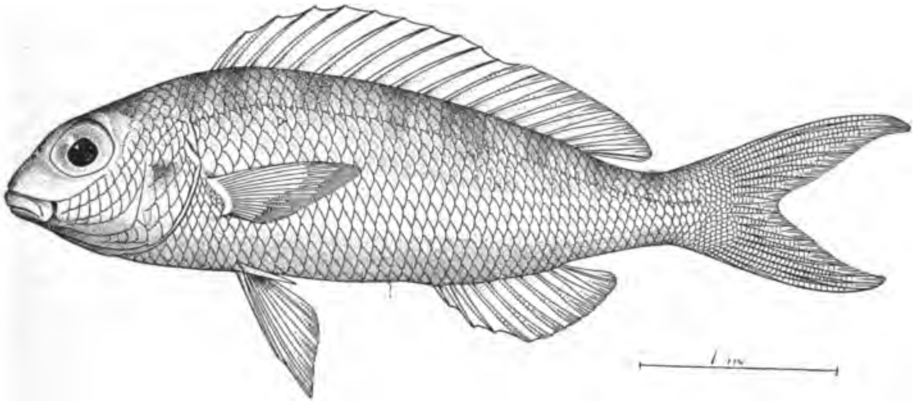

FIG. 7.—*Nemipterus luteus* (Bloch).

105. **Nemipterus luteus** (Bloch).

Head 3.20 in length; depth 4; eye 3 in head; 3 rows of scales on cheek; dorsal x, 9; anal iii, 7; scales about 44. Color yellowish, with 9 dark bands over back and down to lateral line. One specimen from Cavite.

106. **Nemipterus tæniopterus** (Cuvier & Valenciennes).

Head 3.10 in length; depth 3.50; eye 3.50 in head, slightly less than snout; 3 rows of scales on cheek; canine teeth in each jaw; membranes of dorsal slightly incised. Color yellowish white; upper half of body with slight wash of light brownish, a reddish band on fifth row of scales below lateral line; some indistinct lighter longitudinal bands below lateral line; fins not elongate. One specimen from Manila, 5.25 inches long, and one from Cavite, 10.25 inches long.

107. **Nemipterus ovenii** (Bleeker).

Head 3.50 in length; depth 3.50; eye 3 in head; canine teeth in outer row in each jaw; dorsal x, 9; anal iii, 7. Color yellowish white, with 5 dusky vertical bands over back and down to middle of side. One specimen from Cavite, length 3.25 inches.

108. **Nemipterus japonicus** (Bloch).

Head 2.85 in length; depth 3.14; eye 3.80 in head; snout slightly greater than eye; canines in upper jaw and some slightly enlarged teeth in sides of lower mandible; maxillary ending under anterior third of eye; the upper ray of caudal much prolonged; membrane of dorsal but little incised; three rows of scales on cheek; traces of minute denticulations on the limb of preopercle. Color yellowish white, with indistinct lighter lines. Eight specimens from Cavite, length 3.50 to 5.50 inches.

109. **Nemipterus metopias** (Bleeker).

Head 3.20 in length; depth 3.50; eye 3 in head; canines in both jaws; preorbital smooth; 3 rows of scales on cheek; dorsal spines not prolonged; ventral rays prolonged; caudal rays slightly elongate. Color yellowish white; some dusky on opercle. One specimen, 5.95 inches long, from Cavite.

110. **Nemipterus tolu** (Cuvier & Valenciennes).

Head 3.15 in length; depth 3.75; eye 3.20 in head; dorsal x, 9; anal III, 7; the first two dorsal spines very close together; jaws with bands of small teeth; preopercle entire; three rows of scales on cheek; dorsal fins rather elongate, with the membranes deeply incised; lateral conical teeth in each jaw. Color in spirits yellowish white, with indistinct longitudinal lighter lines. One specimen from Cavite, length 5 inches.

Family HÆMULIDÆ.

EUELATICHTHYS Fowler.

The genus or subgenus *Euelatichthys* Fowler is separated from *Plectorhynchus* Lacépède by its large scales.

111. **Euelatichthys crassispinus** (Rüppell).

Head 2.75 in length; depth 2.20; eye 3 in head; dorsal XIV, 15; anal III, 6; the second anal spine very long and strong; preopercle strongly denticulate; minute teeth in jaws. Color brown, uniform; tip of soft dorsal, anal, and all of caudal white. One specimen from Cavite, length 3.75.

SPILOTICHTHYS Fowler.

112. **Spilotichthys pictus** (Thunberg).

Head 3.05 in length; depth 2.50; eye 4 in head; dorsal x, 23; anal III, 7. Color (specimens 6 inches long) yellowish, a broad dusky band from eye extending on caudal; above this band a longitudinal row of spots with another brown band above it; an additional band or row of spots at base of dorsal; below the broad median brown band 2 or 3 rows of spots more or less bandlike; spinous dorsal black, with whitish at anterior base; soft dorsal with dusky margin; a dark band thru the middle with brown spots on each side; caudal with margins dusky, with white markings forming irregular circles; anal dusky without spots; ventrals tipped with dusky; dusky on base of pectoral. In young examples the color pattern is very different; specimens 3 inches long show no spots, but the side of body is taken up by the wide median stripe of black; this type of coloration intergrades perfectly with that of the adult.

In 2 specimens still larger, 6.25 inches, the adult coloration, spots without bands, is shown. These spots are not connected, but arranged in longitudinal series; belly plain; dorsal and caudal with brown spots and margined with black; anal and ventrals dusky, without spots; caudal very slightly emarginate.

We have no occasion to question Bleeker's determination of this species. In all its changes with age, it may be known by the presence of but 10 (or 9) dorsal spines, the distinctive character of the genus *Spilotichthys* of Fowler.

A fine series of 11 specimens from Cavite, length 1.50 to 6.25 inches.

113. **Scolopsis vosméri** Bleeker.

Two young examples from Cavite, 2 and 2.25 inches in length, and 4 from Manila, 3.50 inches long. Young with the color in spirits yellowish brown, the characteristic silvery band over the opercular spot and dark in axil of pectoral.

114. **Scolopsis luzonia** Jordan & Seale, new species.

Head 3.18 in length without caudal; depth 3.18; eye 2.75 in head; snout 3.25; interorbital equal to snout; dorsal x, 9; anal III, 7; scales 42; preopercle serrated; a rather strong spine on preorbital; head scaled; a prominent serrated ridge on the maxillary.

Body oblong, slightly compressed; depth of caudal peduncle equal to orbit; mouth rather small, the maxillary ending under the anterior margin of eye; bands of villiform teeth in jaws, none on vomer or palatines; gillrakers very short and blunt, about 5 on lower limb; origin of dorsal somewhat in advance of origin of ventrals; distance from tip of snout to origin of dorsal 1.45 in base of dorsal; third dorsal spine 2.10 in head, longest dorsal ray 2; base of anal 2; pectoral 4 in length without caudal; caudal moderately forked.

Color in spirits yellowish; upper part with a slight wash of light brown; upper and lower parts of iris dusky; fins all yellowish white.

One specimen from Cavite, the type, 3.2 inches long, no. 9243, Museum Stanford University.

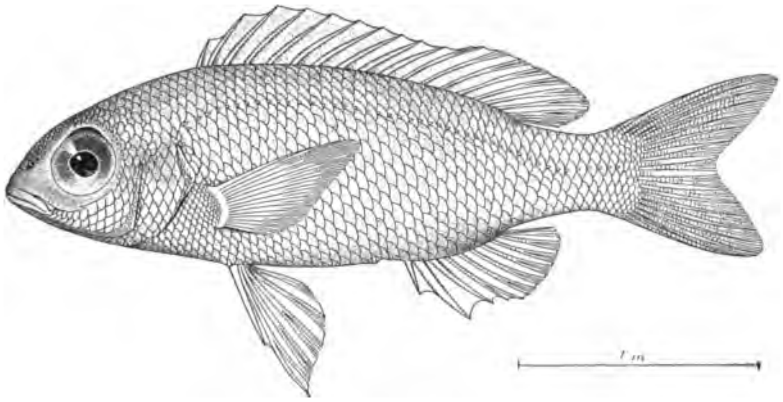

Fig. 8.—*Scolopsis luzonia* Jordan & Seale, new species. Type.

115. **Scolopsis ciliata** (Lacépède).

Head 3.20 in length; depth 3; eye 3 in head; dorsal x, 9; anal iii, 6; spine of preorbital of moderate strength; preopercle distinctly serrated. Color yellowish; a single silvery white line between lateral line and spinous dorsal. One specimen from Manila, length 3.75 inches.

POMADASIS Lacépède.

116. **Pomadasis argenteus** (Lacépède).

Head 2.75 in length; depth 2.90; eye 3.50 in head; dorsal xii, 14; anal iii, 7; preopercle denticulate. Color grayish, silvery below; the upper half of body with dark spots forming sinuous lines, a dusky blotch on opercle; dorsal fin with black spots forming more or less regular dusky lines. One specimen from Cavite, length 3.35 inches.

117. **Pomadasis maculatus** (Bloch).

Head 3 in length; depth 2.75; eye 4 in head; dorsal xii, 13; anal iii, 6; scales 50; patches of small teeth in jaws; mouth small; maxillary ending under nostril, preopercle serrated; opercle entire. Color yellowish, with 5 oblique dusky bands descending to about median line; spinous dorsal with a dusky blotch, soft dorsal dusky at tip; other fins yellowish. Nine specimens from Cavite, length 3 to 8 inches.

PENTAPUS Cuvier.

118. **Pentapus vittatus** (Bloch).

Head 3.50 in length; depth 3.75; eye 3.25 in head; scales 45; dorsal x, 9; anal iii, 6. Color brownish: 3 whitish stripes on upper half of body from eye, the upper along base of dorsal, the middle along anterior half of lateral line, the lower from side of snout through lower part of orbit to caudal; below this line a dusky band parallel with it, forming a dusky axil to pectoral.

TERAPON Cuvier.

119. **Terapon jarbua** (Forskål).

Head 3 in length; depth 3; eye 3.75 in head; dorsal xii, 10; anal iii, 9; scales 85. Color silvery, with brownish bands; dorsal spine with a large dusky blotch; soft dorsal with 2 dusky blotches. Four specimens from Cavite, length 4 to 6.75 inches.

120. **Terapon puta** (Cuvier & Valenciennes).

Head 3.10 in length; depth 3.95; eye 3.25 in head; dorsal x, 12, 10; anal III, 9; scales numerous; maxillary extending to below anterior margin of eye. Color grayish, with 4 dusky longitudinal lines, one from tip of snout to tip of caudal, the other from superior orbit to posterior axil of dorsal; caudal with a median central line and 2 oblique lines; spinous dorsal with a large dusky blotch.

Another example: Head 3.20 in length; depth 3.50; dorsal XII, 10; anal III, 8; scales 54. Color grayish, with 4 longitudinal brown lines, the upper one indistinct, running along base of dorsal and over top of head, the 3 broader lines below this, 2 or more oblique brown bands on tail apparently the continuation of the lines on side; dorsal with black blotch.

Four specimens from Manila, length about 1.3 inches, and 3 specimens from Cavite, length about 2.75 inches.

The species is easily distinguished by the very strong tooth-like spines at angle of preopercle.

121. **Terapon quadrilineatus** (Bloch).

Head 3.12 in length; depth 3.12; dorsal XII, 10; anal III, 10; eye 3.25 in head; serration at angle of preopercle rather strong, but even. Color grayish, with 5 dusky longitudinal lines; a dusky spot, not very distinct, on the shoulder; spinous dorsal with small dusky blotch. Six specimens from Manila, length about 1.50 to 3 inches.

122. **Terapon theraps** (Cuvier & Valenciennes).

Head 3.50 in length; depth 2.75; eye 3.50 in head; dorsal XII, 10; anal III, 8; scales 54; preopercle strongly but evenly serrated. Color dull grayish, with 3 longitudinal dusky bands, caudal with 2 oblique dusky bands; spinous dorsal with a large dusky blotch; soft dorsal with 2 dusky blotches; anal and ventrals with dusky blotches. One specimen from Iloilo, length 3.50 inches.

Family SPARIDÆ.

LETHRINUS Cuvier.

123. **Lethrinus mahsenoides** Bleeker.

Head 3 in length; depth 2.50; dorsal x, 9; anal III, 8; scales 48 to end of vertebræ; eye 1.90 in snout; maxillary thin, its median width 2 in pupil. Color, dull yellowish white. One specimen 9.20 inches long; 4 young examples, length 3 to 4 inches. The young have slight indications of dark blotches.

Easily distinguished from *Lethrinus ramak* by the narrow maxillary.

124. **Lethrinus amboinensis** Bleeker.

Head 3 in length; depth 2.50; dorsal x, 9; anal III, 8; scales 52; eye 1.95 in snout; maxillary at middle equal to pupil. Color yellowish silvery, a black blotch below lateral line above middle of pectoral. Upper profile of head convex. One adult example, 7.50 inches in length; 1 young example from Cavite 2 inches long.

Family GERRIDÆ.

XYSTÆMA Jordan & Evermann.

125. **Xystæma punctatum** (Cuvier & Valenciennes).

(*Gerres filamentosus* Cuvier & Valenciennes.)

Head 3 in length; depth 2.20; dorsal IX, 10; scales 49; first dorsal ray elongate, reaching to posterior dorsal ray. Color light yellowish brown above, with about 7 vertical bands on side down to median line; silvery below; dusky spot on axil; in old examples these bands take more or less the form of bands of spots. Nine specimens from Cavite, length 2 to 5.25 inches.

PENTAPRION Bleeker.

126. **Pentaprion longimanus** (Cantor).

Head 3.40 in length; depth 2.75; eye 2.75 in head; dorsal IX, 14; anal V, 13; scales deciduous. Color yellowish white; a dusky opercular spot; a slight shade of dusky on anterior membranes of spinous dorsal, otherwise fins unmarked. Six specimens from Cavite, length 2.75 to 3.5 inches.

Family SCIÆNIDÆ.

PSEUDOSCIÆNA Bleeker.

127. **Pseudosciæna anea** (Bloch).

Head 3 in length; depth 3.20; eye 4.10 in head; dorsal xi, 24; anal ii, 7; canines in jaws; maxillary 2.10, ending on line with middle of eye, posterior limb of preopercle serrated; opercle with two small spine-like points. Color yellowish; a yellow streak from opercle to caudal along median line; a dusky blotch on opercle and on upper part of orbit; spinous dorsal dusky, otherwise fins unmarked. Two specimens from Cavite, length 4.23 and 5 inches.

UMBRINA Cuvier.

128. **Umbrina russelli** Cuvier & Valenciennes.

Head 3.25 in length; depth 3.25; eye 3.25 in head; dorsal xi, 25; anal ii, 7; scales 52; snout overhanging, no enlarged canines; teeth in outer half of maxillary slightly larger; barbel half length of eye. Color yellowish; a dark blotch on opercle; spinous dorsal dusky; other fins unmarked. Four specimens from Cavite, length about 3.25 inches.

129. **Umbrina dussumieri** Cuvier & Valenciennes.

Head 3.10 in length; depth 3.75; eye 4.20 in head; dorsal xi, 25; anal ii, 7; barbel at symphysis, short, less than one-half of eye, small teeth in jaws, with anterior ones of maxillary slightly enlarged; spinous dorsal high, 1.20 in depth. Color dull yellowish, shaded with brownish, more or less blotched; lower half of body brighter; spinous dorsal shaded with dusky; caudal with some dusky; other fins unmarked. One specimen from Cavite, length 7 inches.

Family SILLAGINIDÆ.

SILLAGO Cuvier.

130. **Sillago sihama** (Forskål).

Head 3.45 in length; depth 5.75; eye 4.75 in head; scales 73. Color yellowish, with a longitudinal silvery band; an indistinct blotch of dusky on upper part of opercles. Seven specimens from Cavite, length 3.50 to 6 inches.

Family MULLIDÆ.

PSEUDUPENEUS Bleeker.

(*Upeneus* Günther; *Parupeneus* Bleeker.)

131. **Pseudupeneus barberinus** (Lacépède).

Head 3 in length; depth 5; eye 4 in head; scales 31; barbels reaching to below middle of opercle. Color yellowish, a brown line along side of snout through eye to below middle of soft dorsal fin; a black spot on base of caudal peduncle; fins without markings. One specimen from Iloilo, length 3.75 inches.

132. **Pseudupeneus indicus** (Shaw).

Head 3.20 in length; depth 4; eye 5 in head; snout rather pointed; barbels reaching to below angle of preopercle. Color dull yellowish white, a golden elongate blotch on and above lateral line between the 2 dorsal fins; a distinct brown spot on each side of caudal peduncle; fins unmarked. Two specimens from Iloilo, length about 5 inches.

UPENEUS Cuvier. (*Upeneoides* Bleeker.)

133. **Upeneus luzonius** Jordan & Seale, new species.

Head 3.60 in length without caudal; depth 4.05; eye 4 in head; dorsal viii–i, 8; anal i, 6; scales 34; barbels reaching to below angle of preopercle; first dorsal fin high, its height equal to or greater than depth of body; snout 2.40 in head; interorbital 1.75 in snout.

Body moderately elongate and compressed; depth of caudal peduncle 2.25 in head; mouth moderate the maxillary 2.35 in head; upper jaw slightly the longer; a band of small teeth in jaws, teeth on vomer and palatines; gillrakers small, sharp-pointed, 12 developed on lower limb, the longest 2.5 in orbit; dorsal fin high, length of second dorsal spine greater than depth of body, about equal in length to head; 5 rows of scales, between the dorsal fins; height of second dorsal 1.75 in head, none of its rays elongate; base of anal 2.50, its longest ray 2; origin of anal slightly nearer origin of ventrals than base of caudal; pectoral 1.40 in head; ventrals 1.20; caudal well forked, equal to length of head.

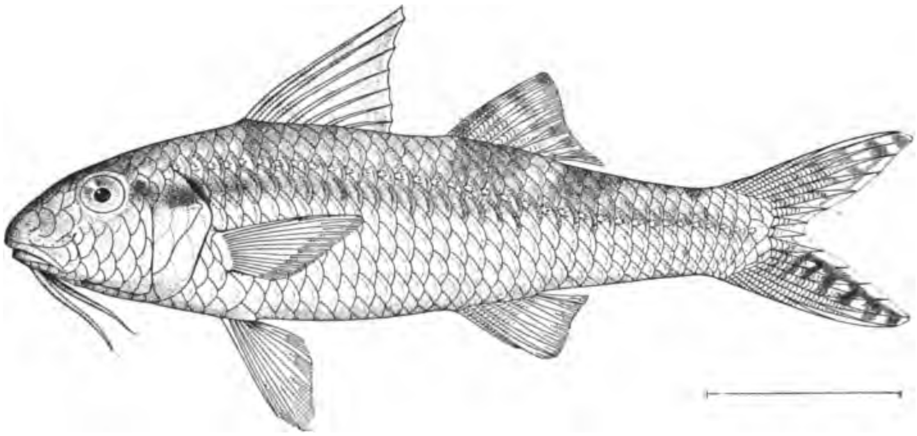

FIG. 9.—*Upeneus luzonius* Jordan & Seale, new species. Type.

Color in spirits dull yellowish, with tint of brown; a brown line from eye along median line to caudal; a brown saddle over anterior half of caudal peduncle, a second less distinct band of brown extending down on side from anterior two-thirds of soft dorsal; some brownish indistinct markings on top of head and side of snout; upper and lower lobes of caudal with 4 oblique cross-bands as in *Upeneus vittatus;* spinous and soft dorsals with 3 rather indistinct dusky bands; remaining fins unmarked.

Seven specimens from Cavite. The type, 4.75 inches long, is no. 53067, U. S. National Museum. Cotypes, no. 9244, Museum Stanford University.

134. **Upeneus sulphureus** (Cuvier & Valenciennes).

Head 3.40 in length; depth 3.40; eye 3.75 in head; scales 38. Color yellowish; spinous dorsal with 3 dark bands, the upper one forming the tip of fin and being most distinct; soft dorsal with 3 indistinct cross-bands, the tip dusky; tip of caudal dusky, other fins yellowish. Fourteen specimens from Cavite, length 2 to 6.75 inches.

135. **Upeneus tragula** (Richardson).

Head 3.50 in length; depth 4.25; eye 4 in head; scales 2-32-7; barbels reaching to angle of preopercle. Color dull silvery, much blotched and spotted with brown; the caudal fin with 4 oblique brown bands; spinous dorsal tipt with dusky, with some brown spots; soft dorsal with 2 brown bands; anal and ventrals with brown markings. One specimen from Manila and 2 specimens from Iloilo, length about 4 inches.

Family ANABANTIDÆ.

ANABAS Cuvier.

136. **Anabas scandens** (Daldorf).

Head 2.9 in length; depth 2.3; eye 5.25 in head; dorsal XVIII, 10; anal X, 9; strong serrations on opercle, and very strong spine-like teeth on subopercle. Color olive brown, a lighter blotch on posterior of opercle. Two specimens from Cavite, length 5.25 inches.

Family OPHIOCEPHALIDÆ.

OPHIOCEPHALUS Bloch.

137. Ophiocephalus striatus (Bloch).

Head 3.85 in length; depth 5.50; dorsal 45; anal 26; scales 55; scales on top of head large and irregular. Color in spirits dusky above, this color forming dark longitudinal lines which extend to the white of the belly; two dark lines backward from angle of mouth. Two specimens from Cavite, length 8.50 and 9 inches.

Family CEPOLIDÆ.

ACANTHOCEPOLA Bleeker.

138. Acanthocepola abbreviata (Cuvier & Valenciennes).

Head 6 in length; depth 9; eye 3.50 in head; dorsal 70; anal 73; teeth in a single row in both jaws; scales small but distinct; dorsal and anal continuous with caudal; a strong spine at angle of preopercle followed by 4 spinelets on its lower limb. Color yellowish, with indistinct traces of numerous vertical bands on back; anal and dorsal tipped with dusky. Nine specimens from Cavite, length 5 to 7.25 inches.

Family POMACENTRIDÆ.

DASCYLLUS Cuvier.

139. Dascyllus aruanus (Linnæus).

Head 3 in length; depth 1.75; eye 2.50 in head; dorsal XII, 11; anal II, 11. Color in spirits yellowish, with 3 deep black cross-bands, one covering nuchal region and snout, the second from fifth to seventh dorsal spines to ventrals; the third covering posterior dorsal down to posterior of anal; caudal yellow. Five specimens of this well-known species from Cavite, length 1 to 2.25 inches.

140. Dascyllus trimaculatus (Rüppell).

Head 3.75 in length; depth 1.60; eye 3 in head; dorsal XII, 14; anal II, 12; scales 3-27-11; anterior of head and snout bluntly and evenly rounded, the snout and mouth not projecting. Color blackish, tip of soft dorsal yellowish, a yellowish white spot under middle of dorsal fin, the one on nuchal region apparently obsolete; fins black. One specimen from Manila, length 3.50 inches.

POMACENTRUS Lacépède.

141. Pomacentrus tripunctatus Cuvier & Valenciennes.

(*Pomacentrus trilineatus* Ehrenberg.

Head 3.40 in length; depth 2; eye 3.50 in head; dorsal XIII, 15; anal II, 15; scales 3-27-9; preopercle and orbital strongly denticulate. Color in spirits rich brown; caudal yellow; fins blackish.

Two fine specimens from Cavite, length about 4 inches, colored as above.

A specimen 3 inches long, from Cavite, is dull brown with dark spot in axil of pectoral and on top of caudal peduncle; caudal yellow; anal and ventral black; some bluish on snout.

Another specimen from Cavite, 2.50 inches long, is dull yellowish brown, a black spot at origin of lateral line and in axil of pectoral; fins yellowish-brown, except dusky wash on dorsal; some bluish on snout; caudal yellow.

A small specimen, length 2.50 inches, from Cavite, is brown, with yellow caudal, a black dot at origin of lateral line; a narrow blue line from snout over top of head on each side; another along side of snout through eye, a slight dusky blotch in soft dorsal.

ABUDEFDUF Forskål.

142. **Abudefduf turchesius** Jordan & Seale, new species.

Head 3.25 in length; depth 2.40; eye 3 in head; snout 4; interorbital 3.50; dorsal xiii, 13; anal ii, 12; scales 2–28–9; preopercle entire; opercle with a small but distinct spine at its posterior margin.

Body oblong, compressed; jaws even, angle of mouth under anterior third of eye; head and body firmly scaled; depth of caudal peduncle equal to its length, which is 2 in head; a single row of blunt pointed teeth in each jaw; suborbital above angle of mouth equal to one-half width of pupil; gillrakers slim and sharp, about 12 on lower limb; spinous dorsal rather low, the longest spine 2.50 in head; dorsal rays longer, 1.20; base of anal 2.50 in base of dorsal, its longest ray 1.20; pectoral equal to head; ventrals with outer rays prolonged, reaching to base of anal; caudal rounded, equal to head.

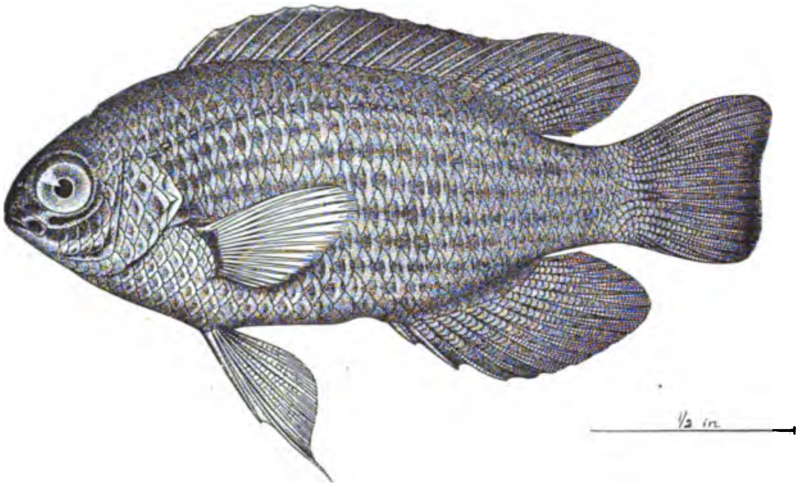

FIG. 10.—*Abudefduf turchesius* Jordan & Seale, new species. Type.

Color in spirits uniform deep blue, slightly lighter, with yellowish wash on thorax and belly; fins all uniform blue except pectorals and ventrals, which are gray.

One specimen from Cavite, type no. 9245, Museum Stanford University, length 2 inches.

143. **Abudefduf saxatilis** (Linnæus).

Head 3.20 in length; depth 2; eye 3.20 in head; dorsel xiii, 13; anal ii, 13. Color dull grayish white; 5 wide black vertical bands on side; a black spot at axil of pectorals; fins dusky, no black lines extending into caudal; lower part of body with yellowish wash. One specimen from Manila, length 4.35 inches.

Family LABRIDÆ.

CHŒROPS Rüppell.

144. **Chœrops anchorago** (Bloch).

Head 3 in length; depth 3; eye 5 in head; dorsel xiii, 7; anal iii, 9; scales 30; cheek with imbricate scales; preopercle serrated. Color in spirits yellowish with the upper anterior two-thirds of body black, invaded at middle of pectoral by a yellow band; posterior part of body, belly, soft dorsal caudal, anal, pectoral and ventrals yellow, dusky at axil of pectoral. One specimen from Manila, length 4.75 inches.

LEPIDAPLOIS Gill.

145. **Lepidaplois macrurus** (Lacépède).

Head 3 in length; depth 2.95; dorsal XII, 9; anal III, 12; scales 32. Color in spirits yellowish white; 4 red bands through interorbital space over nuchal region and back over upper half of body; 2 similar lines through eye and 2 or 3 below eye, these extending back on body; a wide deep black area below soft dorsal, at the lateral line sending an oblique band-like projection of black downward and backward, running out on lower caudal rays to tip; ventrals black; margin of anal black, a dusky wash on belly. One specimen from Manila, length 10 inches.

HALICHŒRES Rüppell.

146. **Halichœres nigrescens** (Bloch & Schneider).

Head 3.20 in length; depth 3; eye 6 in head; dorsal IX, 12; anal III, 12; a strong canine at angle of jaw; scales 28. Color in spirits yellowish, with bluish gray on upper two-thirds of body more or less distinctly arranged in 8 or 9 cross-bands; a blue-black yellow-edged ocellus between the fifth to seventh dorsal spines; margins of caudal bright yellow, the inner part with blue and yellow cross-bands, dusky below; a black spot in axil of pectoral; outer edge of dorsal and anal bluish, the inner half of these fins with roundish yellowish markings; head with blue lines. Three specimens from Manila, length 3.75 to 5.20 inches.

147. **Halichœres hyrtli** (Bleeker).

Head 3.50 in length; depth 4; dorsal IX, 12; anal III, 11; scales 29; teeth in a single row in each jaw, with a distinct posterior canine. Color in spirits yellowish, the scales with a tint of brown; a wide distinct brown band from snout through eye tc base of caudal; a black yellow-edged ocellus at posterior end of this line on base of caudal; a brown band along base of caudal; the lines of each side uniting at tip of snout; a black spot between the first and second dorsal spines at base sometimes extending back to third spine; dorsal, anal, and caudal with indistinct reticulating lines or white spots; base of pectorals with a black spot. Three specimens from Manila, length 2.50 to 3.10 inches.

148. **Halichœres scapularis** (Bennett).

Head 3 in length; depth 4; eye 4 in head; snout 3.75; interorbital 1.75 in snout; dorsal IX, 11; anal III, 11; scales 3–27–9; a distinct canine at angle of jaws.

Body oblong, moderately compressed; depth of caudal peduncle 2.30 in head; snout rather sharp-pointed, the lips thick; sharp-pointed teeth in a single series in each jaw; the anterior canines of each jaw slightly enlarged; posterior canines distinct; gillrakers short, sharp-pointed, 11 on lower limb; scales in front of dorsal and on thorax small, 9 series in front of dorsal; dorsal fin low, its longest spine 2.50 in head, the rays slightly longer; base of anal equal to length of head, its longest ray 2.50 in head; pectorals 1.60; ventrals 2.10; caudal rounded, 1.75.

Color in spirits dull gray; a distinct black stripe from eye along side to upper base of caudal; a narrow narrow indistinct light line on the median line from lobe of opercle to middle of caudal; fins yellowish white without markings; no black spot in axil of pectoral or on base of caudal.

Two specimens from Panay, length 2.75 inches.

A specimen from Manila which was 5.50 inches long had head 4 in length; depth 4; eye 5.50 in head; a blunt tooth at angle of mouth; some small scales behind the eye. Color in spirits (specimen much faded), above grayish green, the scales with darker centers, yellowish below; caudal banded; dorsal and anal with 2 or 3 longitudinal bands of dusky and yellowish; cheek with bands and dots, especially a band behind eye and 2 spots on upper part of opercle; a dusky oblique band on each side of belly from inner axil of pectoral.

149. **Halichœres binotopsis** (Bleeker).

Head 3.20 in length; depth 3.75; dorsal IX, 11; anal III, 11; scales 28. Color in spirits (badly faded) yellowish, with indistinct dusky spots and 4 or 5 indistinct cross-bands; a black dot on upper base of caudal; a dusky ocellus between first and second dorsal spines and another between first and second dorsal rays; some lines on head, one of which forms a short but rather wide vertical dark line behind eye.

Another specimen has the head 3 in length; depth 3.50; eye 4 in head. Color in spirits bluish, with 5 dark bands with white lines between them; dorsal with ocelli; anal with a row of ocelli; caudal with ocelli; a black bar behind eye; lines on cheek not forming a complete circuit.

Numerous specimens from Cavite, length 2.25 to 3.25 inches.

150. **Halichœres miniatus** (Kuhl & Van Hasselt).

Head 3.95 in length; depth 3.50; eye 4.50 in head. Anal fin with fine black dots; dorsal with spot in middle; a black bar behind eye and a black dot in front; about 5 dark bars over back and 5 along side, these more or less united by longitudinal dark band; dorsal with oblique dusky lines. Several specimens from Manila and Cavite.

151. **Halichœres argus** (Bloch & Schneider).

Head 3.35 in length; depth, 3.35; eye, 4.20 in head. Each scale with a round spot on a blue field; dorsal and anal with round spots on blue field; caudal dusky at tip, with round rings on rest of fin; stripes on thorax; blue lines on head; a lighter line above lateral line; six white marks each side of dorsal. Three specimens from Cavite.

152. **Halichœres pœcilus** (Richardson).

(*Halichœres annulatus* Fowler.)

Head, 2.55 in length; depth, 3.75; eye, 3.75 in head. Three bands of color along side; about six dark bands over back; a dark bar behind eye with a dark line from its upper and lower part; a dark line from eye to snout, a large black ocellus in middle of dorsal; another between anterior spines, the fin with markings extending into it from the body; anal with row of rings at base followed by a line; markings on cheek variable the dark sometimes forming complete rings. Numerous specimens from Cavite.

153. **Halichœres pseudominiatus** (Bleeker).

Head 3 in length; depth 3.50; eye 4.75 in head. One specimen from Cavite, with which *H. opercularis* of the South Seas may prove to be identical, but in the latter the silver band under eye always curves back near posterior edge of opercle and extends forward across lower part of cheek, while in *H. pseudominiatus* it ends at opercle or at its base, not doubling back sharply as in *H. opercularis*.

STETHOJULIS Günther.

154. **Stethojulis phekadopleura** Bleeker.

Head 3 in length; depth 3.10. Color brownish above, white below with 3 rows of brown dots along lower part of side; a brown spot at base of caudal. Three specimens from Cavite.

155. **Stethojulis bandanensis** (Bleeker).

Head 2.95 in length; depth 3. Color drab, light brown above, yellowish below; a white spot above axil of pectoral; base of pectoral brown; 3 small black dots on caudal peduncle, and a black spot between posterior rays.

Other specimens show the following coloration: Drab above, yellowish white below, the colors not meeting sharply on body, but on head the division sharply marked by a white line extending from snout to a little past posterior of opercle, where it forms a white characteristic spot just above axil of pectoral; 3 black dots on caudal peduncle, 1 between posterior rays of dorsal and one, or a slight indication of one, between the last rays of anal.

Numerous specimens from Cavite. This species, found also at Samoa, is very near *Stethojulis axillaris* of Hawaii, but apparently distinct.

156. **Stethojulis kalosoma** Bleeker.

Head 3.98 in length; depth 4, eye 4.50 in head. A black line from posterior orbit to about tip of pectoral very indistinct; 4 lines of dots along lower side with fine specks between them, no black dot on fin; dorsal with indistinct oblique lines. Several specimens from Cavite.

THALASSOMA Swainson.

157. **Thalassoma lunare** (Linnæus).

Head 3.20 in length; depth 3.50; eye 5 in head; dorsal VIII, 13; anal II, 11; scales 26; a single row of teeth in jaws. Color in spirits, body olive-brown, the center of each scale with a short vertical stripe; head deep blue; caudal yellow, outer rays with dusky; dorsal and anal blue with the outer third yellow; 2 brown longitudinal stripes on each side of thorax below pectoral; a blue line around under jaw from angle to angle, with a median blue line to tip of under jaw; pectoral with deep blue on upper part; caudal rays prolonged. One specimen from Cavite, length 4.55 inches.

158. **Thalassoma dorsale** (Quoy & Gaimard).

Head 3 in length; depth 3.10; eye 5.75 in head; dorsal VIII, 13; anal III, 11; scales 29; caudal lunate. Color in spirits yellowish white, with 7 black bands over side and down almost to median line on side; head with broad red bands; dorsal with dusky longitudinal band through middle, the outer part yellow, tip of caudal dusky, anal yellow with dusky black. One specimen from Manila, length 5 inches.

CHEILINUS Lacépède.

159. **Cheilinus trilobatus** Lacépède.

Head 2.50 in length; depth 2.85; dorsal IX, 10; anal III, 8; scales 20. Color in spirits brownish, with 4 wide dark bands on side; a black spot at base of eighth to ninth dorsal rays; 3 black spots on median line on posterior half of body; some black spots in anal; soft dorsal whitish; numerous light colored dots and short lines on head. One specimen from Manila, length 4.75 inches.

160. **Cheilinus rostratus** Cartier.

Head 3 in length; depth 2.60; eye 5 in head; dorsal IX, 10; anal III, 9; scales 24; preopercle serrated; caudal rounded; profile of head above snout concave, the snout slim and conical, its length 3 in head. Color in spirits yellowish white; 4 rather irregular dusky blotches or bands on side of body; a dusky band from eye vertically down to throat; upper lip with dusky spots; some dusky blotches on dorsal and anal; caudal with some dusky bars. One specimen from Iloilo, length 4 inches.

HEMIPTERONOTUS Lacépède.

161. **Hemipteronotus pentadactylus** Lacépède.

Head 4 in length; depth 3.25; eye 4.50 in head; dorsal II–VII, 12; anal III, 12; scales 28. The first 2 dorsal spines elongate and separate from rest of fin; cheek scaly. Color in spirits yellowish white, a black blotch on side of body above posterior third of pectoral fin, a longer light yellowish blotch just below this black spot; fins unmarked. Two specimens from Manila, length 3.75 and 4.20 inches.

Family SCARICHTHYIDÆ.

CALLYODON Gronow (*Scarus* Forskål.)

162. **Callyodon lacerta** (Cuvier & Valenciennes).

A young example 3.75 inches long, probably of this species, from Iloilo has the following characteristics: Head 3 in length; depth 3; eye 4 in head; 3 rows of scales on cheek, the middle row of 6 scales, the lower of 2; lips entirely covering the white teeth; caudal rounded. Color uniform yellowish brown, no bars or markings; dorsal with slight tip of dusky; anal with 2 indistinct bands.

163. **Callyodon eleræ** Jordan & Seale, new species.

Head 3.10 in length; depth 2.95; eye 6.50 in head 2.50 in snout; dorsal IX, 10; anal II, 8; scales 2–25–6, 3 rows on cheek, the lower row of 4 scales covering the lower limb of preopercle; lips narrow, covering about two-thirds of upper jaw; teeth green, with 2 strong canines at angle.

Body oblong, rather deep; depth of caudal peduncle 2.75 in head; head bluntly but evenly pointed; seven rows of scales in front of dorsal; dorsal fin rather low, its longest ray 2.75 in head; base of anal fin 1.30 in head, 2.20 in base of dorsal; pectoral 1.30 in head; ventral 1.55; caudal rather deeply lunate, the lobe almost equal to length of head.

Color in spirits dull yellowish, the upper half with a wash of brown darker on shoulders and upper half of head, the colors being distinctly separated on cheek, on line with lower part of orbit; lips yellow, followed by a broader green line which extends back to eye, the yellow margin on lower lip very narrow; a slightly darker band extending across part of interorbital space; dorsal fin yellowish with a slight wash of green, a narrow line of dark green at margin; anal yellow with a broad green margin; ventral yellow; pectoral yellow, with wash of dull green; caudal green with the upper and lower intramarginal rays yellowish.

One specimen from Cavite, length 12.50 inches, type no. 9246, Museum Stanford University.

This species is named for the late Fra Castro de Elera, professor in the college of Santo Tomas in Manila, author of a catalog of the fauna of the Philippines.

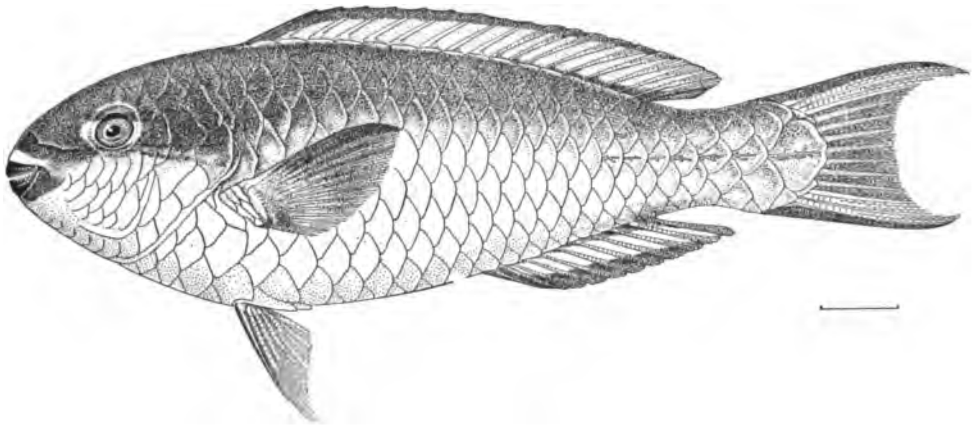

Fig. 11.—*Callyodon eleræ* Jordan & Seale, new species. Type.

Family SCORPIDÆ.

MONODACTYLUS Lacépède (*Psettus* Cuvier).

164. **Monodactylus argenteus** (Linnæus).

Head 3 in length; depth 1.10; eye 2.50 in head; dorsal VIII, 30; anal III, 29; teeth villiform in jaws, vomer, palatines, and tongue. Color silvery, with purplish reflections; a black ocular band through eye; another dusky band over shoulders to posterior margin of opercle; anterior portion of dorsal and anal fins dusky. Four young examples from Cavite, length 1.50 to 4.75 inches.

Family ILARCHIDÆ.

PLATAX Cuvier.

165. **Platax orbicularis** (Forskål).

Head 3 in length; depth slightly less than length; dorsal v, 37; anal III, 27. Color grayish in spirits; a black ocular band which extends down and out on the long ventral fin; another black band at posterior margin of opercle and at base of caudal fin; anterior rays of dorsal and anal dusky; caudal yellow. One specimen, 2.75 inches long, from Iloilo.

Family EPHIPPIDÆ.

EPHIPPUS Cuvier (*Scatophagus* Cuvier & Valenciennes).

166. **Ephippus argus** (Gmelin).

Head 3.05 in length; depth 1.75; pectoral fins short; dorsal XI, 17; anal IV, 13. Color brownish, white on belly, thorax, and chin; scattered black spots over upper half of body; some spots on caudal peduncle; fins dusky. Five specimens from Cavite, length 2 to 5 inches.

Family DREPANIDÆ.

DREPANE Cuvier & Valenciennes.

167. **Drepane punctata** (Gmelin).

Head 2.75 in length; depth 1.10; eye 3.50 in head; dorsal ix, 20; anal iii, 18; scales 50; spine pointing forward under the skin in front of dorsal, second dorsal spine long; pectoral long, reaching about to base of caudal; all specimens have small barbels on each side of throat, with a cluster of about 6 on chin. Color silvery, with about 7 vertical dusky bands made up of black spots, these bands more distinct in young, being less broken up into spots; ventrals partly dusky; head without bands. Five specimens from Cavite, length 2.50 to 6.75 inches.

Family CHÆTODONTIDÆ.

CHELMO Cuvier.

168. **Chelmo rostratus** (Linnæus).

Head 2.35 in length; depth 1.70; dorsal ix, 30; anal iii, 21; snout pointed, 2 in head. Color yellowish, with 4 yellow dark-edged vertical bands, the anterior one forming the ocular band; a large black white-edged ocellus in middle of soft dorsal, at upper part of fourth band; a dark band on caudal peduncle.

The largest example shows: Head 2.50 in length; depth 1.25; snout 4.25 in head; eye 3 in snout. Color in spirits yellowish, with 5 vertical darker bands, the anterior one forming the ocular band; in addition there are numerous longitudinal lines; a large blue-edged ocellus of black on the soft dorsal.

Three specimens from Cavite, length 1.50 to 6.25 inches.

PARACHÆTODON Bleeker.

169. **Parachætodon ocellatus** (Cuvier & Valenciennes).

Head 3 in length; depth 1.10; dorsal xii, 24; anal iii, 20. Color yellowish, with 3 oblique broad bands of light brown on side of body; another similar band occupying posterior portion of dorsal and anal fins, crossing the caudal peduncle, where it has a white line at its margins; a brown ocular band with black margins; the third band of body has a round black ocellus at its upper portion, a dusky line down middle of forehead and snout; ventrals dusky. Nine specimens from Cavite, length 1.50 to 3.50 inches.

GONOCHÆTODON Bleeker.

170. **Gonochætodon triangulum** (Cuvier & Valenciennes).

Head 2.75 in length; depth 1.10; eye 2.80 in head; dorsal xi; anal iii, 26; the posterior of dorsal fin is almost straight with the angle directed inward. Color brownish, darker on posterior of body, with numerous white lines on body forming blunt angles with the point toward the head; 3 dark bands on head, extending on ventral fin; inner half of caudal black; tip of caudal white; a narrow intramarginal black line on anal.

CHÆTODON Linnæus.

171. **Chætodon trifasciatus** Park.

Head 3.35 in length; depth 1.50; dorsal xiii, 12; anal iii, 20. Color dull yellowish, with narrow longitudinal black lines from head to caudal; a black band on caudal; a black wedge-shaped area on posterior part of dorsal and anal; 3 black bands on head, the middle one forming the ocular band; the anterior one on tip of snout; 2 narrow dusky lines on soft dorsal; anal dusky with white margin. One specimen from Cavite, length 4 inches.

172. **Chætodon ornatissimus** Cuvier & Valenciennes.

Head 3.25 in length; depth 1.25; dorsal xii, 25; anal iii, 22. Color yellowish, with grayish wash; 7 wide oblique dusky bands on side of body, about 5 vertical lines on head, the middle one forming the ocular band; 2 black bands on tail; 2 dark lines on dorsal and anal. One specimen from Manila, length 3.25 inches.

173. **Chætodon punctatofasciatus** Cuvier & Valenciennes.

Head 3.60 in length; depth 1.30; dorsal XII, 23; anal III, 17. Color yellowish, with 8 dusky vertical bands from dorsal to middle of body; a white ocular band with dusky margin; a lunate dusky band in caudal; an intramarginal line of black in dorsal and anal; a black spot in front of dorsal fin; lower half of body with distinct round black dots which seem gradually to fade out on upper third of body. Three specimens from Manila, length 3.25 to 3.50 inches.

174. **Chætodon kleini** Bloch.

Head 3.50 in length; depth 1.30; eye 2.75 in head. Color yellowish or grayish, with a wide ocular band from the rather gibbous origin of dorsal thru eye out on ventral fins, which are black; dorsal and anal with narrow intramarginal dusky lines, caudal yellowish; very indistinct indications of dusky on posterior part of body and above middle of pectoral. One specimen from Manila, length 3.20 inches.

HOLACANTHUS Lacépède.

175. **Holacanthus bicolor** (Bloch).

Head 3.75 in length; depth 2; eye 2.50 in head. Anterior third of body bright yellow, posterior two-thirds deep black; a black band between eyes; caudal bright yellow. One specimen of this well-marked fish from Manila, length 4.75 inches.

176. **Holocanthus diacanthus** (Boddært).

Head 3.85 in length; depth 1.85; dorsal XIV, 19; anal III, 19; spine of preopercle reaching to below posterior margin of opercles. Color in spirits yellowish, with about 16 dusky bands from dorsal curving orward and back to ventral surface of body and to anal; curved lines in dorsal and anal; caudal yellow; soft dorsal dusky; 2 deep blue lines on head, one from shoulder behind and below the eye, the other in front of eye. One specimen of this well-known fish from Manila, length 7.50 inches.

Family ACANTHURIDÆ.

HEPATUS Gronow (*Teuthis* Linnæus).

177. **Hepatus celebicus** (Bleeker).

Head 3.25 in length; depth 2; eye 3 in head; dorsal VIII, 25; anal II, 24. Color brown; deep black at posterior margin of opercle; a white band around under jaw; fins blackish; tip of snout black; caudal lunate. One specimen from Manila, length 4.75 inches.

178. **Hepatus matoides** (Cuvier & Valenciennes).

Head 3.20 in length; depth 2; dorsal IX, 28; anal II, 27. Color brown; 4 longitudinal bluish bands in dorsal fin; anal blackish; younger examples with white band on posterior part of caudal peduncle. Two specimens from Iloilo, length 3 and 5.30 inches.

This species is probably identical with *Hepatus guntheri* (Jenkins) and *Hepatus blochii* (Cuvier & Valenciennes).

ZEBRASOMA Swainson.

179. **Zebrasoma rhombeum** (Kittlitz).

Head 3 in length; depth 1.50; snout 1.50 in head; base of caudal spine white, with a large mass of small setæ in front of spine; lower part of body with indistinct longitudinal bluish lines; fins blackish, caudal square. This is probably a color-form of the yellow *Zebrasoma flavescens*. One specimen from island of Panay; length 4.25 inches.

Family SIGANIDÆ.

SIGANUS Forskål.

180. **Siganus javus** (Linnæus).

Head 4 in length; depth 2.20; eye 3 in head; snout 2.75; dorsal XIII, 10; anal VII, 9. Color brown, with numerous small white dots on shoulder and upper part of body and head, becoming larger on side and forming longitudinal lines; on side and below, these lines more or less broken up; belly yellowish; fins yellowish with irregular spots of brownish or with grayish wash; caudal emarginate. Nine specimens from Cavite, length 3 to 4.50 inches.

181. **Siganus virgatus** (Cuvier & Valenciennes).

Head 3.50 in length; depth 2; eye 2.75 in head; dorsal XIII, 10; anal VIII, 9. Dull grayish, tinted with blue, a dusky band from fourth and sixth dorsal spines to axil of pectoral; a black ocular band through eye; narrow cross-bands on top of head and some narrow oblique lines on shoulder; fins yellowish; anal and ventrals with slight wash of dusky. In older examples the cross lines of black on top of head and snout become more distinct and a number of black dots appear behind the second dusky band. Two specimens from the island of Panay, length about 4 inches; one fine specimen 7 inches long from Manila.

182. **Siganus marmoratus** (Quoy & Gaimard).

Head 3.85 in length; depth 2.50; eye 2.75 in head; dorsal XIII, 10; anal VII, 9. Color in spirits brownish, with bluish vermiculating lines about half as wide as iris, inclined to run longitudinally on side, more reticulate on back; caudal banded; soft dorsal and anal with dusky spots on rays forming 2 or more bands. One specimen from Manila, about 3.5 inches long.

183. **Siganus fuscescens** (Houttuyn).

Head 3.50 in length; depth 2.50; eye 3.50 in head; dorsal XIII, 10; anal VII, 9; caudal emarginate. Color in spirits pale bluish; usually with a dusky opercular spot; some scattered dots of light and also of dusky over body; caudal banded. Three specimens from Cavite, 3 to 4 inches in length, and 2 specimens from island of Panay, 2.50 and 3 inches long.

184. **Siganus lineatus** (Cuvier & Valenciennes).

Head 3.75 in length; depth 2; eye 3 in head; dorsal XIII; anal VII, 9. Color in spirits bluish gray with brown dots or lines, the lines on upper part of body usually surrounding light bluish spots, some specimens (not all) showing a yellowish blotch at base of soft dorsal, and corresponding in every respect to the figure of Cuvier & Valenciennes (Hist. Nat. Poiss., pl. 286); belly yellowish white; fins with grayish wash. One specimen from Manila, length 5.75 inches.

185. **Siganus tetrazonus** (Bleeker).

Head 3.50 in length; depth 2.10; eye 3.10 in head; snout 2.50. Color in spirits bluish white, with 4 broad cross bands of dusky over back and down on side; base of caudal dusky; fins splotched with dusky. Three young examples from Manila, length 1.50 to 3 inches, and 2 from Cavite, 2.25 and 5 inches long.

Family BALISTIDÆ.

BALISTAPUS Tilesius.

186. **Balistapus undulatus** (Park).

One fine specimen of this well-known species from Cavite.

Family MONACANTHIDÆ.

MONACANTHUS Cuvier.

187. **Monacanthus chinensis** (Bloch).

Head 2.30 in length; depth 1.10 equal to length without caudal peduncle; dorsal I, 28; anal 28. Color brownish gray, with numerous small dots of brown, caudal with dusky tip. One small specimen an inch long from Manila.

188. **Monacanthus nemurus** (Bloch).

Head 3.10 in length; depth 2.12; eye 4.20 in head; dorsal spine with a row of spinules on each side, 1.75 in head; dorsal 28; anal 29. Color brownish gray, mottled with darker blotches; caudal with 2 dusky bands. Three specimens from Manila, length 3 inches, and 2 specimens from island of Panay, 1.50 and 3.50 inches long.

ALUTERA Cuvier.

189. **Alutera monoceros** (Osbeck).

Head 3 in length; depth 2.25; eye 4.75 in head; dorsal 48; anal 50; dorsal spine feeble, without barbs, situated over middle of eye, its length 3.50 in head; caudal 1.30. Color uniform brownish, posterior part of caudal shaded with dusky. One specimen from Manila, length 5 inches.

Family OSTRACIIDÆ.

OSTRACION Linnæus.

190. **Ostracion cornutum** Linnæus.

Head 3 in length; depth 2.10; eye 2.05 in head. This well-known species is easily distinguished by the long cow-like orbital spines, about equal to length of head. Color grayish or yellowish white, without dots. Five specimens from Cavite, length 1 to 2.50 inches.

191. **Ostracion gibbosum** Linnæus.

Head 3 in length; depth 2. Four ridges to carapace, the 2 upper much closer together and surmounted by a very large strong spine; 4 strong spines along lower lateral ridge. Color yellowish white, with about 4 dusky oblique bars on side. Eleven specimens from Cavite, length 1 to 2.50 inches.

192. **Ostracion tuberculatum** Linnæus.

Head 2.10 in length; depth 1.20; eye 2.20 in head; carapace four-ridged, without sharp spines; a ridge with blunt short spine on middle of carapace. Each plate with a round brown spot about size of pupil. Three specimens from Cavite, length 0.50 to 1 inch.

Family TETRAODONTIDÆ.

SPHEROIDES (Lacépède) Duméril.

193. **Spheroides lunaris** (Bloch).

Head 3.20 in length; depth 3.10; caudal lunate. Color grayish above, white below; top of caudal peduncle dusky. Five specimens from Cavite, length 2 to 4.50 inches, and 2 from Manila, 4 inches long.

The Japanese species called *Spheroides spadiceus* (Richardson) is probably not distinct from *Spheroides lunaris*.

194. **Spheroides ocellatus** (Osbeck).

Back covered with small spines from interorbital space to dorsal fin, side naked, belly spiny. Brownish above; one or more wide blackish cross-bands, one on middle of back, one very indistinct from base of dorsal; tip of head and snout dusky; whitish spots over back and side separated by narrow brownish network, tip of caudal dusky. Two specimens from Manila, length 2.75 and 3.75 inches.

TETRAODON Linnæus.

195. Tetraodon immaculatus Bloch.

Entire body excepting lips and tail covered with spines. Color grayish green, with narrow brown longitudinal stripes over back, side, and belly; caudal with upper, lower, and posterior margin black. One specimen from Cavite, length 3.75 inches.

196. Tetraodon reticulatus Bloch.

Entirely covered with small spines. Color dusky; under part of body covered with numerous brown lines, descending obliquely from cheek posterior of body and caudal fin with bluish spots; dorsal, anal, and pectoral unspotted. One specimen from Cavite, length 4.75 inches.

197. Tetraodon hispidus Linnæus.

Above grayish-green, white below, large round white spots over back; sides of belly with dusky lines, distinct and extending entirely over belly in young. Three specimens from Manila, length about 2 to 3 inches; 1 specimen from the island of Panay, length 4.75 inches.

CANTHIGASTER Swainson.

198. Canthigaster compressus (Procé).

Head 3 in length; depth 2.75. A large black blue-edged ocellus at base of dorsal fin; blue lines on forehead; belly white. Four specimens from Cavite, length 2 to 3.50 inches.

Family SCORPÆNIDÆ.

GENNADIUS Jordan & Seale, new genus.

Gennadius Jordan & Seale, new genus of Scorpænidæ (*Sebastes stoliczæ* Day).

This genus is separated from *Sebastes* and *Sebastodes* by the absence of cranial spines. Dorsal spines xiv; scales large.

199. Gennadius stoliczæ (Day).

Head 2.50 in length; depth 2.80; eye 3.50 in head; dorsal xiv, 10; anal iii, 6; scales 40; teeth villiform in jaws, vomer, and palatines; head scaled but without spines except a single spine on opercle; preopercle serrated. Color in spirits yellowish, marbled with brown dusky bars across all the fins and dark bands radiating from eye and on lips. One specimen from the island of Panay, length 4.50 inches.

This species is well figured by Dr. Francis Day (Fishes of India, 148, pl. xxxvi, fig. 1).

SEBASTOPSIS Gill.

200. Sebastopsis scabra (Ramsay & Ogilby).

Head 2.20 in length; depth 3; eye 3.50 in head; interorbital 1.50 in eye; an orbital tentacle; dorsal xii–i, 9; anal iii, 5; second anal spine long, about equal to longest ray; dark bands over body; caudal peduncle lighter, with dark bar at base of caudal; a dark spot on opercle. Several specimens from Cavite, identical with others from Samoa.

SEBASTAPISTES Gill.

201. Sebastapistes tristis (Klunzinger).

Head 2.20 in length; depth 2.50; dorsal xii, 9; anal iii, 4; second anal spine 2.20 in head, prominent compound orbital tentacle about equal to eye. Color in spirits grayish, mottled with brown; brown band on lips and chin. One specimen from the island of Panay, length 1.20 inches.

The species is very close to our *Sebastapistes laotale* from Samoa, but the latter lacks the orbital tentacle.

SCORPÆNOPSIS Bleeker.

202. Scorpænopsis cirrhosa (Thunberg).

Head 2.75 in length; depth 3.20; dorsal x, i, 10; anal iii, 5; second anal spine 2 in head; interorbital space less than eye, 1.50 in snout; numerous large dermal flaps or tentacles over head, body, and fins; very large dermal flaps on chin. Color in spirits grayish, marbled with dusky in the form of black bands over back; fins with dusky bands and marblings. A single fine specimen of this well-known species from the island of Panay, length 6.25 inches.

203. Scorpænopsis nova-guineæ (Cuvier & Valenciennes).

Head 2.50 in length; depth 3.12; eye 5.12 in head; dorsal xi, i, 9; anal iii, 5; the second anal spine about equal to length of longest anal ray; interorbital less than eye; an orbital tentacle; several tentacles on lower jaw and over body. Color reddish, mottled with brownish; fins more or less barred with brown; no black spot between fifth and sixth spines of dorsal; no black spots in axil of pectoral. Numerous specimens from Cavite, apparently identical with a specimen from Samoa.

DECTERIAS Jordan & Starks.

204. Decterias pusillus (Schlegel).

Head 2.20 in length; depth 3.20; interorbital space 1.50 in eye; preorbital spine of moderate strength; dorsal spines slender, extending above membrane; lower pectoral ray separate from rest of fin. Color grayish, with dusky markings above; pectoral black; ventrals black; anal with outer half black; caudal mottled with dusky on outer two-thirds. Two specimens from island of Panay, length 1.75 and 1.90 inches. These are identical with Japanese examples.

Family PLATYCEPHALIDÆ.

PLATYCEPHALUS Bloch.

205. Platycephalus insidiator (Forskål).

Head 3.10 in length; depth 3.10; dorsal i-vii, 13; anal 13; lateral line smooth, scales about 120; head almost smooth. Color in spirits brownish above, white below, side of head and body with numerous brown spots; caudal with 3 black stripes; dorsal fins barred with brown dots; pectoral dotted with brown; ventrals and anal white. Two specimens from Cavite, length 6 and 9 inches.

206. Platycephalus isacanthus (Cuvier & Valenciennes).

Head 3 in length; depth 7; eye 4 in head; interorbital 3 in eye; dorsal i-viii, 12; anal 12; ventral long, 1.20 in head, its tip reaching beyond origin of anal; 2 spines at angle of preopercle, the upper slightly the larger, its length about equal to pupil of eye; no spine bent forward; lateral line unarmed; about 60 series of scales on body, head spinous. Color brownish, mottled; fins all, except anal, with rows of brown spots. Two specimens from Cavite, length 2.75 and 5.20 inches.

207. Platycephalus macracanthus Bleeker.

Head 3 in length; depth 9; eye 4 in head; scales 70; dorsal i-viii, 11; anal 12; 2 spines at preopercle, the upper one very long and strong, reaching to posterior margin of opercle; interorbital 3 in eye. Color in spirits nearly uniform, mottled with brown; ventrals, pectorals, and first dorsal dusky; second dorsal and caudal with bands of dots; dots also showing in upper part of pectorals and in spinous dorsal. One specimen from Manila, length 3.35 inches.

208. Platycephalus punctatus Cuvier & Valenciennes.

Head 3 in length; depth 2.50; eye 4.50 in head; lateral line unarmed; scales 110; 2 spines at angle of preopercle, the upper the larger; alternating wide and narrow black bands over back; anterior dorsal dusky; ventrals and pectoral dusky; caudal dusky at base, with about 4 dusky longitudinal bands. Two specimens from Cavite, length 2 and 5 inches.

ELATES Jordan & Seale, new genus.

Elates Jordan & Seale, new genus of *Platycephalidæ* (*thompsoni*).

This genus is characterized by the single spine at the angle of the opercle, the small scales and the large, elongate upper caudal lobe. It is allied to *Platycephalus*.

209. Elates thompsoni Jordan & Seale, new species.

Head 3.30 in length without caudal; depth 4 in head; eye 5; snout 2.75; dorsal I-V, 13; anal 12; about 125 scales in lateral line to end of vertebræ; lateral line smooth, except 2 small spines at its anterior end.

Body elongate, slightly compressed, the width greater than depth; under surface of body rather flat; body and cheek firmly scaled; caudal peduncle narrow and flat, its width greater than depth; snout flat, its width at angle of mouth 1.50 in length; maxillary short, 3.50 in head, its distal end scarcely reaching second nostril; lower jaw projecting; a single long saber-like spine at angle of preopercle, this spine considerably longer than diameter of eye, being 4 in head; no spine directed forward; 3 very small spines on bony stay of cheek, one on a line with middle of pupil and another with posterior margin of eye, the third with posterior nostril; distance between distal ends of preopercular spines 2.10 in head; width of head at base of these spines 2.75 in head; a rather distinct spine on upper anterior margin of orbit and about 10 small spines at upper and posterior margin of orbit; 2 small nuchal spines; interorbital space narrow, concave, less than width of pupil; minute bands of teeth on jaws, vomer, and palatines; tongue broad, rounded, spatulate, free; gillrakers rather sharp and slim, the longest equaling one-half of eye, 18 on lower limb; first dorsal spine small, somewhat separated from second, which is the longest and strongest spine, being 2.60 in head; first soft dorsal ray 2.10; seventh to eleventh rays rather wide and separated from other rays except at base, origin of soft dorsal slightly nearer base of caudal than tip of snout; origin of anal slightly in advance of soft dorsal, its base slightly greater in length than base of soft dorsal; pectorals 2.10 in head; ventrals 2, their spine strong, their origin below middle of pectoral; caudal slightly forked, the upper lobe much the larger and longer, usually prolonged into a filament which is about equal in length to remaining portion of fin.

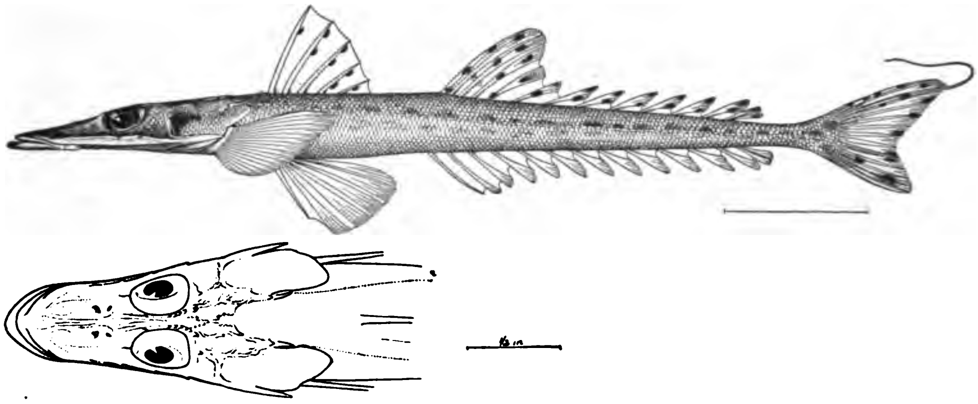

FIG. 12.—*Elates thompsoni* Jordan & Seale, new species. Type.

Color in spirits yellowish, with wash of brownish above; an indistinct broken longitudinal brown band along side; a dusky splotch on anterior of opercle; spinous dorsal with 3 rows of dark spots; soft dorsal and upper lobe of caudal with spots; lower lobe of caudal with spots larger, about 3 in number, the posterior one being a rather large blotch; pectorals and ventrals yellow.

Three specimens from Manila, length 6 to 7 inches. The type is no. 53068, U. S. National Museum. Cotype no. 9247, Museum Stanford University.

Named for Dr. Joseph C. Thompson, surgeon, U. S. Navy.

Family CEPHALACANTHIDÆ.

CEPHALACANTHUS Lacépède.

210. Cephalacanthus macracanthus (Bleeker).

Head (without spine) 3.75 in length; depth 5.10; dorsal i–i–v, 8; anal 6; interorbital spine 2 in head and much less than length of preopercular spine, which extends considerably beyond base of pectoral fin, its length being about equal to head; distance between the two scapular spines 1.50 in depth of notch between them, which about equals length of preopercular spine; a black spot on pectoral. Two specimens from Manila, 3.75 and 4.20 inches in length, one specimen 3 inches long from island of Panay, and one 2.50 inches long from Cavite.

Family ECHENEIDÆ.

LEPTECHENEIS Gill.

211. Leptecheneis naucrates (Linnæus).

Head 5.30 in length; depth 2.25 in head; disk of 24 laminæ; dorsal 35; anal 34; a dark stripe on side. Two specimens from Manila, length 14 and 8 inches.

Family GOBIIDÆ.

BUTIS Bleeker.

212. Butis serrifrons (Rutter).

Head 3 in length; depth 3.75; eye 4.50 in head; interorbital concave, 3 in postocular part of head; dorsal vi; anal 8; scales 27; cheeks and nuchal region scaled; entire upper half of orbit with a row of short but distinct, rather stiff spine-like projections, forming a very marked character; two longitudinal rows of similar projections on each side of snout just above the nostrils; cheeks and jaws with minute barbels; bands of villiform teeth in jaws; mouth rather large, the maxillary extending to below anterior of eye; ventrals separate; caudal rounded; dorsal spines not prolonged. Color in spirits olive brown, with darker mottlings; about 4 indistinct bands over back; dorsal, ventrals, and anal black; pectoral and caudal grayish; a black spot on base of lower pectoral rays; throat bluish. One specimen from Cavite, length 2.30 inches.

Rutter's original type specimen is from China.

213. Butis leucurus Jordan & Seale.

Head 3 in length; depth 5; eye 6 in head; dorsal vi–i, 9; anal 9; scales 28; 19 scales in front of dorsal; counting only to interorbital space; sides of head and snout covered with minute scales; tongue free, rounded, teeth in bands, no canines, no teeth on vomer or palatines; opercle and preopercle entire; maxillary scarcely reaching anterior margin of eye; caudal rounded; ridges on head scarcely serrated. Color in spirits dusky, with indistinct lighter lines along middle of scales; a distinct black spot edged above and below with yellow on base of pectoral; soft dorsal with outer half yellowish; top of caudal yellowish; tip of anal and ventral yellowish; pectoral yellow; two black lines through eye. Several specimens from Cavite, larger and more deeply colored than the original type from Negros.

PERIOPHTHALMODON Gill.

214. Periophthalmodon schlosseri (Bloch).

Head 3.50 in length; depth 6.50; dorsal xii, 12; anal 13; scales 50; ventral fins united for almost half their length; about 20 teeth in each jaw. Color in spirits brownish, with 8 bands over back which extend obliquely down and forward to a little below median line of side; second dorsal with black band through upper half of fin; first dorsal with tip yellow and a wide submarginal black band. One specimen from Cavite, length 3.50 inches.

PERIOPHTHALMUS Bloch & Schneider.

215. **Periophthalmus chrysospilus** Bleeker.

Head 3.75 in length; depth 4.80; dorsal IX, 12; anal 12; scales about 76; about 24 teeth in each jaw; first dorsal spine prolonged. Color in spirits bluish, whiter below; first dorsal with a broad submarginal black band, the margin yellow, the basal two-thirds of fin with yellowish spots; soft dorsal with a wide black band margined with yellow through its upper third, the lower two-thirds with yellowish blotches; caudal with black and yellow dots, the middle portion darker; ventral fins united about one-third of their length. Four specimens from island of Panay, length 2.50 to 3.75 inches.

RHINOGOBIUS Gill.

216. **Rhinogobius nebulosus** (Forskål).

Head 3.30 in length; depth 4.50; eye 3.75 in head; dorsal VI–10; anal 10; scales 27; depth of head slightly greater than its width, about one-fourth less than its length; caudal rounded; head unscaled; tongue rounded; teeth in several rows in each jaw; lips thick; the second and third dorsal spines prolonged, filiform, greater than length of head, 2.75 in length of fish without caudal; no silky or detached rays on pectorals. Color yellowish, three wide dark bands over back which extend obliquely forward and down on side; a dusky blotch at base of caudal; two dusky bands across nuchal region between base of dorsal and eyes; dorsal and caudal with rows of rather large dusky spots; other fins yellowish white, with a dusky margin to anal. One specimen from Cavite, length 4 inches.

As the type of *Ctenogobius* is said to have a notched tongue, the name *Rhinogobius* may be used for the Asiatic species called *Ctenogobius* by Jordan and Snyder. *Coryphopterus* is a later synonym.

217. **Rhinogobius lungi** Jordan & Seale, new species.

Head 3.30 in length without caudal; depth 4.50; eye 3.75 in head; dorsal VI–10; anal 10; scales 32; head and nuchal region naked, except a line of 3 or 4 rows of scales from posterior margin of orbit between opercle and nuchal region; snout 3 in head; interorbital about equal to pupil. Body moderately elongate, compressed; head bluntly rounded, the lower jaw slightly the longer; mouth rather small, the angle being on line with anterior margin of eye; teeth in jaws in several rows, the outer row slightly the largest; tongue free at tip, bluntly rounded, entire; scales on anterior of body smaller than on posterior, about 7 rows of rudimentary scales in front of dorsal; second and third spines of dorsal elongate, the second longer, extending when depressed to middle of base of soft dorsal, its length greater than distance from origin of ventrals to origin of anal; longest dorsal ray 2.15 in head; base of anal 1.50, its longest ray 2.50; caudal rounded, 1.15; pectorals 1.30, no silk-like rays at upper margin; ventrals united, 1.50, tips not reaching vent.

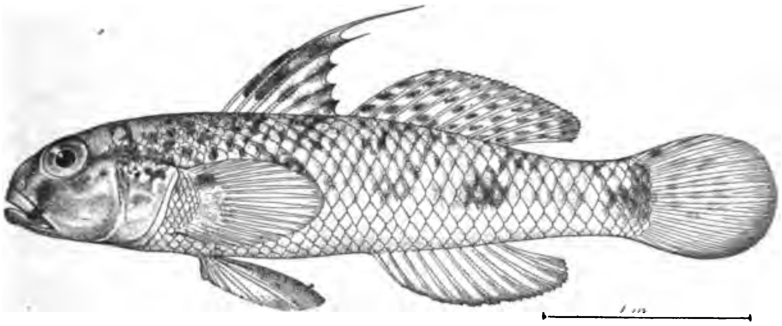

FIG. 13.—*Rhinogobius lungi* Jordan & Seale, new species Type.

Color in spirits yellowish-brown with 6 irregular dark double bands over back; about 5 dusky blotches along the side, the last forming a dusky blotch at base of caudal; dusky mottlings intermingled with lighter areas on the upper half of body; dorsal and caudal with rows of black spots; lower margin of caudal dusky;

pectorals yellowish without distinct black mark at base; ventrals grayish with dusky tip; anal yellow, with black tip; some indistinct brown blotches on cheek and opercle; a dusky blotch from eye to mouth.

Three specimens from the island of Panay, length 1.50 to 3.90 inches. The type is no. 53069, U. S. National Museum. Cotype, no. 9248, Museum Stanford University.

218. **Rhinogobius ocyurus** Jordan & Seale, new species.

Head 3.60 in length without caudal; depth 4.05; eye 3.20 in head; dorsal vi–i, 10; anal i, 9; second dorsal spine elongate, filiform; scales about 28; snout 4 in head; interorbital somewhat less than pupil; top of head scaled, otherwise cheek and head naked. Body moderately elongate, slightly compressed; depth of caudal peduncle 2 in head; mouth moderate in size, the angle under middle of eye; lower jaw slightly the longer; small sharp-pointed teeth in jaws, the outer row larger; tongue rounded; origin of ventrals directly opposite origin of spinous dorsal; base of soft dorsal about equal to head; base of anal slightly less than head, its origin nearer base of caudal than tip of snout, its longest ray 1.10 in head; pectorals 1.60 in length of body without caudal; ventrals extending to anal, their length equal to head; caudal long, sharp-pointed, 2.20 in length of fish without caudal.

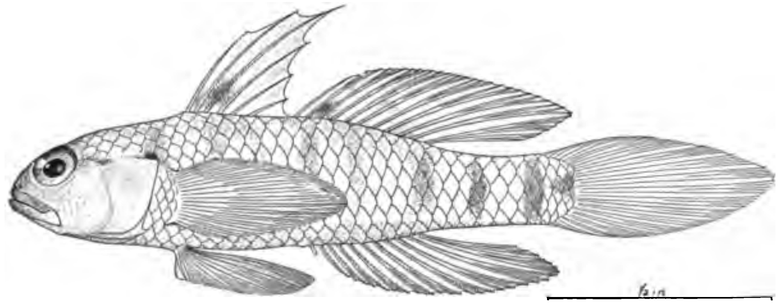

FIG. 14.—*Rhinogobius ocyurus* Jordan & Seale, new species. Type.

Color in spirits yellowish white with 8 rather broad brownish bands over back and sides, extending to ventral surface; a dark spot at base of caudal, another just above the upper posterior margin of opercle; dorsal fins slightly shaded with dusky; pectoral yellowish; caudal with slight tint of dusky; ventrals and anal dusky.

One specimen from Cavite, length 1.75 inches, type no. 53070, U. S. National Museum.

GOBIUS Linnæus.

219. **Gobius panayensis** Jordan & Seale, new species.

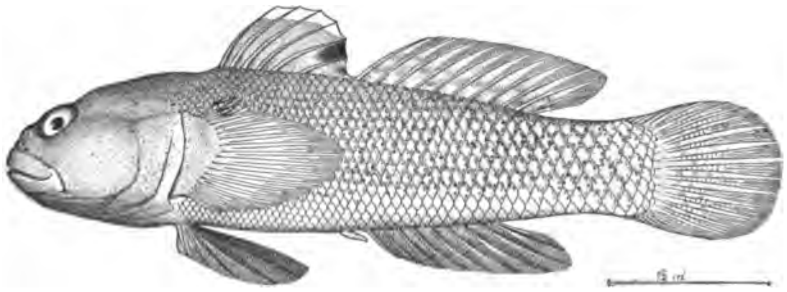

FIG. 15.—*Gobius panayensis* Jordan & Seale, new species. Type.

Head 3.40 in length without caudal; depth 4.25; the width of head greater than its depth; dorsal vi–11; anal 9, scales 41; head naked; some detached silky rays at upper part of pectorals; snout 3.60 in head; interorbital about equal to pupil; tongue not at all emarginate, free at tip, bluntly rounded, entire.

Body moderately elongate, compressed; snout bluntly pointed, the jaws equal; mouth moderate, the angle under middle of eye; wide bands of minute teeth in each jaw; no canines; origin of first dorsal slightly posterior to origin of ventrals; none of the dorsal spines elongate, the longest spine being 2 in head; base of soft dorsal 1.10, its longest ray 2.50; base of anal 1.50, its posterior ray 2; pectorals 1.30; ventrals united, short, 1.50, their tips falling far short of the distinct anal papilla; caudal rounded, 1.15.

Color in spirits grayish, without distinctive markings; spinous dorsal with black spot on upper posterior part; ventrals and anal dusky; pectorals and caudal uniform gray.

One specimen from the island of Panay, length 2.45 inches, type no. 9250, Museum Stanford University.

MAPO Smitt.

220. **Mapo fuscus** (Rüppell).

Head 3.20 in length; depth 4; dorsal vi–11; anal 9; scales 38; no scales on head; teeth in bands in jaws; no canines; ventrals united; none of the dorsal spines prolonged; some separate filamentous rays at upper part of pectoral; depth of head less than width; length of head greater than width; caudal rounded. Color in spirits grayish; indistinct brownish bands over the back alternating with blotches on the side; indistinct dusky blotches on the upper part of spinous dorsal; caudal barred with brown; ventrals and anal dusky; pectorals grayish. Two specimens from Cavite, length 1.20 and 2 inches.

CREISSON Jordan & Seale, new genus.

Creisson Jordan & Seale, new genus of Gobiidæ (*validus*).

This genus is characterized by the naked lower half of cheek and the scaleless interorbital region. There are several rows of teeth in each jaw, the outer row enlarged; scales on anterior part of body and head small.

221. **Creisson validus** Jordan & Seale, new species.

Head 3.50 in length without caudal; depth 3.50; eye 4.75 in head; dorsal vi–11; anal 9; scales 32; upper half of cheek and nuchal region scaled, no scales on interorbital region, snout, or lower third of head; snout 3.75 in head; interorbital 1.20 in eye; cheek tumid; head broader than deep, its breadth 1.08 in its length.

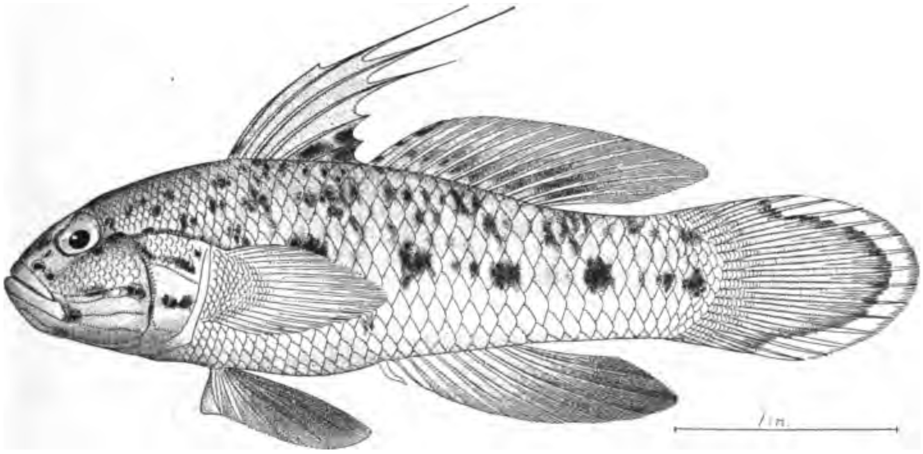

FIG. 16.—*Creisson validus* Jordan & Seale, new species. Type.

Body robust, moderately elongate and compressed, the anterior profile bluntly rounded, the lower lip slightly the longer; depth of caudal peduncle 1.85 in head; mouth small, the angle under the anterior of orbit; tongue free at tip, rounded, entire; several rows of minute teeth in each jaw with one outer row of larger teeth, somewhat curved and canine-like in lower jaw; tongue rounded or subtruncate, not notched; scales on anterior part of head and body much smaller than the posterior ones; origin of spinous dorsal somewhat posterior to origin of ventrals; 17 rows of scales in front of dorsal; the second, third, and fourth dorsal rays greatly elongate, filiform, extending, when depressed, to posterior axil of soft dorsal; base of soft dorsal equal to width of head, the posterior rays the longest, about equal in length to base of fin; anal base 1.50 in head, much less than length of its longest ray; pectorals 1.13, no silky rays at upper part; ventrals a broad united disk which extends to the prominent anal papilla, their length 1.40 in head; caudal slightly acuminate.

Color in spirits light brownish, with about 7 indistinct dusky bands over back and about 6 dusky blotches along side; a dusky line on cheek marking off the scaled and unscaled portion; a dusky dot on lower posterior margin of orbit, some dusky dots on nuchal region, and a dusky line on upper part of opercle; spinous dorsal grayish, with some indistinct darker spots; soft dorsal gray, with some darker spots on outer portion; anal and ventrals dusky, pectorals grayish; caudal gray with broad posterior margin of white and a distinct intramarginal line of black, the lower rays slightly tipped with dusky.

One specimen from Cavite, length 4.75 inches, the type, no. 9251, Museum Stanford University.

OPLOPOMUS Steindachner.

222. Oplopomus vergens Jordan & Seale, new species.

Head 3.50 in length without caudal; depth 4.30; eye 4 in head; dorsal vi–i, 10; anal 10; scales 32; cheek and opercle scaled; 2 stoutish spines at angle of preopercle; snout 3.50 in head; interorbital equal to pupil. Body moderately elongate, slightly compressed; depth of caudal peduncle 2.25 in head; anterior profile of head rather blunt, lower jaw slightly the longer; mouth rather small, the angle below anterior margin of iris; tongue free at tip, rounded, entire; 2 rows of small sharp-pointed teeth in upper jaw, several rows in lower jaw, no canines; origin of ventrals on line with dorsal, the anterior dorsal spines not elongate; fourth spine the longest, 1.75 in head; base of soft dorsal equal to head, its longest ray 1.60 in head; base of anal 1.10, its longest ray 2; pectorals 1.05; caudal rounded, 1.10; ventrals large, united, extending to anal papillal

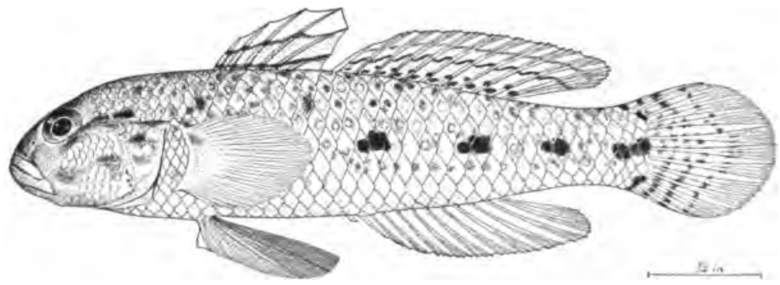

FIG. 17.—*Oplopomus vergens* Jordan & Seale, new species. Type.

Color in spirits yellowish brown, 6 dusky spots along median line of side, the sixth forming a black spot at base of caudal; a row of small ocellated dark spots just below the median line; similar small ocellated spots on upper half of body arranged more or less in irregular longitudinal bands; about 7 indistinct short dusky bands over back; a more or less distinct dusky area below and also in front of eye, a rather wide irregular dusky area from angle of mouth to opercle; a dusky spot on upper base of pectorals, with a small dot on lower part of base; a dusky spot at upper margin of opercle and above axil of pectorals; spinous dorsal with 10 black cross-lines, one at base of fin, the other on distal third, a more prominent dusky area on posterior of fin; soft dorsal with 2 or 3 irregular dusky lines; caudal with about 5 dusky bands; pectorals, ventrals, and anal gray, the ventrals slightly darker, and the anal sometimes with a slight dusky wash.

Six specimens from Cavite, length 2.75 to 3.20 inches. Type no. 53071, U. S. National Museum. Cotype no. 9256, Museum Stanford University.

OXYURICHTHUS Bleeker.

223. Oxyurichthus cristatus (Day).

Head 4 in length; depth 5.20; eye 4.20 in head; dorsal vi–14; anal 14; scales about 55; no canine teeth; head naked; ventrals united; anterior dorsal rays longest, filiform, about equal to elongate middle ray of caudal, 2.20 in length without caudal; no tentacle above eye; a black spot on upper part of eye, one also below the eye; caudal acuminate.

Color in spirits yellowish with some dusky bands over back and extending obliquely down to median line of side in form of about 5 dusky bars or blotches; a dark spot at base of caudal; caudal fin thickly dotted with black; area above pectoral fin with numerous black dots; a short nuchal crest with black margin; caudal gray with white margin; pectorals and ventrals gray.

224. **Oxyurichthus tentacularis** (Cuvier & Valenciennes).

Head 4 in length; depth 5.20; eye 4.50 in head; dorsal VI-13; anal 14; small sharp-pointed teeth in each jaw; a small tentacle over eye, in young this tentacle equal to length of eye, in the adult less; a crest on nape.

Color in spirits whitish, with dull wash of gray; about 5 indistinct dusky bands over back and same number of blotches on side; a more or less distinct dusky spot at base of caudal on midline of caudal peduncle, also 2 indistinct dusky spots at base of axil of pectorals; a black area on top of caudal peduncle just posterior to soft dorsal; anterior dorsal rays the longest, about equal to length of head; caudal lunate, grayish; dorsal with brown spots, more numerous and distinct on soft dorsal; anal, pectorals, and ventrals grayish.

Four specimens from Cavite. length 3.75 to 4.80 inches.

PARAGOBIODON Bleeker.

225. **Paragobiodon melanosomus** (Cuvier & Valenciennes).

Head 3.30 in length; depth 3; eye 3.20 in head; dorsal V-VI-9; scales 22; ventrals very short, cup-shaped; head about as high as long, its surface much roughened by excrescences; caudal rounded; 3 large curved canine teeth in lower jaw. Color in spirits uniform dark brown, almost black. One specimen from Manila, 1.10 inches long.

This species is very near *Paragobiodon xanthosomus*, differing apparently only in the color, which is black, not yellow.

Family PLEURONECTIDÆ.

PSETTODES Bennett.

226. **Psettodes erumei** (Bloch).

Head 3.10 in length; depth 2.25; dorsal 54; anal 38; scales about 72; long sharp canines in each jaw; maxillary extending far beyond eye, about 1.45 in head; eyes and color on the left side. Color in spirits uniform brown; fins dusky, except pectorals, which are yellowish; ventrals and caudal round; interorbital less than eye. One specimen, 4.75 inches long, from Cavite.

PSEUDORHOMBUS Bleeker.

227. **Pseudorhombus polyspilus** (Bleeker).

Head 3 in length; depth 2.05; dorsal 70; anal 52; scales 73; a single row of sharp teeth in jaws; maxillary scarcely reaching middle of eye; lateral line strongly curved, sending a branch to the tenth dorsal ray; eyes close together, sinistral. Color in spirits brownish, with numerous blue spots having black margins; a large black spot at curve of lateral line, another just below. Six specimens from Cavite, length 2.50 to 5 inches.

228. **Pseudorhombus arsius** Bleeker.

Head 3.25 in length; depth 2.05; eyes sinistral; dorsal 72; anal 57; scales 77 in lateral line, which is strongly bent, sending a branch to nuchal region; rather strong sharp teeth in jaws; maxillary extending to posterior third of eye; anterior dorsal rays wide. Color in spirits brownish, with numerous small black spots; a dark spot at point where lateral line becomes straight, another midway between the first blotch and caudal. One specimen, 4 inches long, from Cavite.

SCÆOPS Jordan & Starks.

229. **Scæops orbicularis** (Bleeker).

Dorsal 84; anal 63; scales large, about 34; eyes sinistral, wide apart; interorbital space concave, scaled, equal to eye; maxillary short, ending under anterior margin of orbit; numerous small sharp-pointed teeth in jaws. Two small specimens from Cavite, length 2 and 2.50 inches.

Family SOLEIDÆ.

CYNOGLOSSUS Hamilton-Buchanan.

230. Cynoglossus puncticeps (Richardson).

Head 4.75 in length; depth 3.75; two lateral lines on colored side; dorsal 89; anal 70; scales about 110. Color in spirits yellowish, with reddish-brown markings on left side, these taking more or less the form of vertical bands. Three specimens from Manila, length 2.75 to 3.50 inches.

MICROBUGLOSSUS Günther.

231. Microbuglossus humilis (Cantor).

Eyes on right side; head 3.75 in length; depth 2.20; dorsal 56; anal 41; scales 100; numerous fringes on upper and lower portion of head on the blind side; upper eye one-half diameter in front of lower; eyes about one diameter apart. Color in spirits dark gray, with numerous fine dark points and irregular lines; pectoral black. Two specimens from Cavite, length 2 inches.

Family PTEROPSARIDÆ.

PARAPERCIS Gill.

232. Parapercis hexophthalmus (Bleeker).

Head 3.50 in length; depth 7; dorsal v, 22; anal ii, 17; scales 60. Color in spirits brownish above, yellowish below; about 11 brown bands on side; dusky blotches on caudal, about 10 oblique lines from lower part of eye; anterior dorsal black; posterior dorsal with 3 rows of black dots; anal with a single row of black dots.

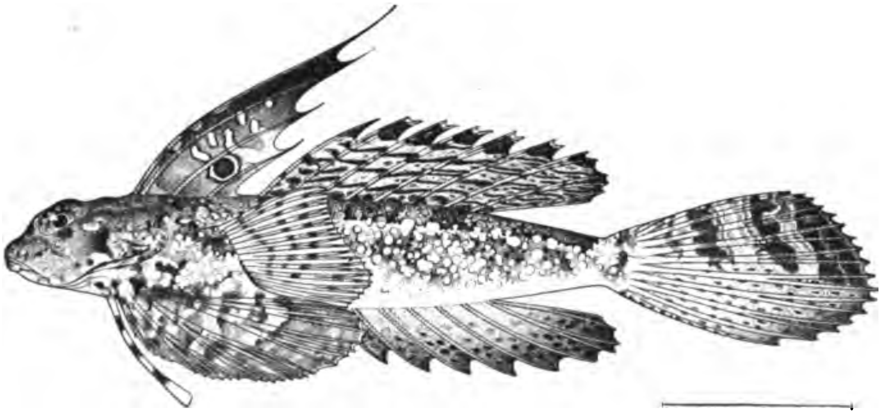

Fig. 18.—*Dactylopus dactylopus* (Bennett).

Family CALLIONYMIDÆ.

DACTYLOPUS Gill.

233. Dactylopus dactylopus (Bennett).

Head 3.50 in length; depth 6.50; eye 4.20 in head; first dorsal elongate; ventrals in front of pectorals, with a single free ray in front; a single opercular spine. Color brownish, with dusky blotches; pectoral banded; caudal with 4 half bands on upper part; anal with dusky outer half; belly white. Three specimens from Cavite, length about 4.50 inches.

Family BLENNIIDÆ.

BLENNIUS Linnæus.

234. Blennius thysanius Jordan & Seale, new species.

Head 3.50 in length without caudal; depth 3.50; eye 5.50 in head; dorsal XI, 15; anal 19; lateral line bent down to middle of side under posterior part of spinous dorsal and continued as a row of distinct bars to base of caudal; snout 2.60; interorbital 1.50 in eye; a wide, fan-like orbital tentacle with about 10 fringes, these tentacles about equal in height and width to width of eye; a simple short tentacle at nostril; no nuchal crest or tentacles; gill membranes broadly united, free from the isthmus. Body of greater depth than usual in blennies, the profile of head blunt, the eye being about on line with middle of side of mouth; depth of caudal peduncle 2.70 in head; each jaw with a single row of immovable small, sharp-pointed teeth, the lower jaw with 2 strong, curved canines on each side, the upper with a single posterior canine. Dorsal fin continuous, not incised, the membrane not extending to caudal fin; origin of dorsal on nuchal region slightly in advance of posterior margin of preopercle; base of anal fin 1.75 in base of dorsal; 2 anterior rays of anal modified into enlarged fleshy bulbs, probably of sexual significance; ventrals 1.80 in head; pectorals 1.40; caudal rounded, 1.90.

Color in spirits pale bluish, with some very indistinct indications of 5 or 6 slightly darker bands made up of spots over back and down sides; dorsal bluish, with slightly darker margin; anal bluish, a narrow white margin with intramarginal dusky shading on lower third; ventrals bluish with tint of dusky; some indistinct bluish dots or mottlings on nuchal region and at upper part of opercle.

Two specimens from Cavite, length 2.50 and 2.90 inches. The type is no. 53072, U. S. National Museum. Cotype, no. 9252, Museum Stanford University.

PETROSCIRTES Rüppell.

235. Petroscirtes eretes Jordan & Seale.

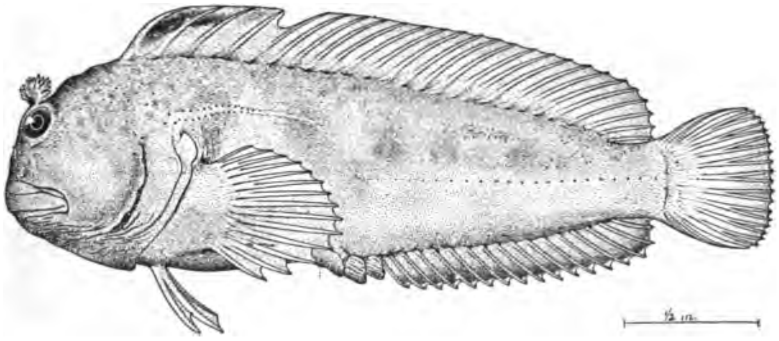

FIG. 19.—*Blennius thysanius* Jordan & Seale, new species. Type.

Head 3.75 in length; depth 5; eye 3.75 in head; dorsal 30; anal 20; a dermal flap on lower jaw, one on upper part of each eye, one on posterior part of supraorbital, and one on each side of nuchal region. Color in spirits grayish, with a wash of bluish; indistinct specks and mottlings on side; a dusky blotch at base of caudal. One specimen 2 inches long from Iloilo. The original type is from Negros.

236. Petroscirtes vulsus Jordan & Seale, new species.

Head 4 in length without caudal; depth 5; eye 3 in head; dorsal 27; anal 16; teeth about 50 in each jaw, with large canines in lower and small canines in upper; a single wide barbel on each side of chin; a rather wide barbel on upper part of eye, another just posterior to eye, and one on each side of nuchal region; a short flap at nostril; snout 3.20 in head, interorbital space 4 in head.

Body elongate, compressed; depth of caudal peduncle 2.50 in head; snout broad to the tip; angle of mouth under anterior of orbit; gill-opening a small pore at upper posterior margin of opercle; origin of dorsal opposite origin of ventrals; base of anal 2.75 in length of fish without the caudal; origin of anal midway between middle of eye and base of caudal; pectorals 1.75 in head; ventrals 2; caudal rounded, 1.15.

Color in spirits uniform pale bluish without markings; no dusky blotch at base of caudal; dorsal fin with rows of black spots; anal fin with 4 dusky bars; caudal yellow, with 5 or 6 indistinct dusky bars; pectorals and ventrals yellowish.

One specimen from Manila, the type, 2.2 inches long, no. 9253, Museum Stanford University.

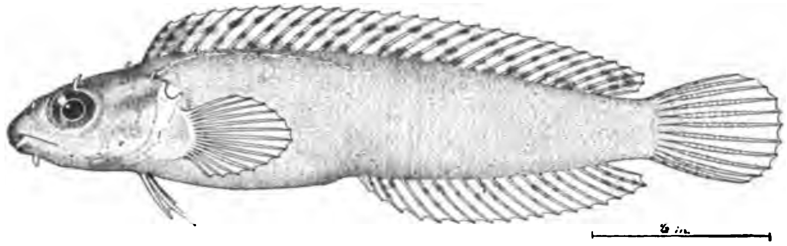

FIG. 20.—*Petroscirtes vulsus* Jordan & Seale, new species. Type.

Family FIERASFERIDÆ.

FIERASFER Cuvier

237. **Fierasfer homei** Richardson.

Head 7.10 in length; depth 12; eye 5 in head; maxillary extending beyond posterior margin of eye, its length 2.15 in head; pectoral 1.75; sharp-pointed teeth in jaws, enlarged teeth on vomer. Color in spirits uniform white. One specimen, 4 inches long, from Cavite.

Family ANTENNARIIDÆ.

PTEROPHRYNE Gill.

238. **Pterophryne histrio** (Linnæus).

Head 1.75 in length; depth 1.80; dorsal III, 12; anal 7; body smooth with dermal flaps on belly; caudal rounded. Body mottled with dusky and white, with numerous small white dots; fins barred with dusky; belly with dark cross-bars. Four specimens from Manila, length 3.50 to 7.25 inches.

This species agrees fairly with the Japanese form called *Pterophryne ranina* by Jordan, except that the belly has distinct cross-bars. Probably *Pterophryne ranina* is merely a color variation of the Chinese-Japanese species *Pterophryne histrio*.

ANTENNARIUS (Commerson) Lacépède.

239. **Antennarius hispidus** (Bloch).

Head 1.75 in length; depth 3; dorsal III, 12; anal 7. Color in spirits gray, marked with black lines running obliquely on body and radiating from eye; fins barred more or less with rows of black dots. One specimen, 4.55 inches long, from Cavite; one 3.75 inches long from Manila, and one 4.5 inches from island of Panay.

FISHES OF THE PHILIPPINE ISLANDS.

By BARTON WARREN EVERMANN, A. M., Ph. D., and ALVIN SEALE, A. B.

BUREAU OF FISHERIES DOCUMENT NO. 607.

FISHES OF THE PHILIPPINE ISLANDS.

BY BARTON WARREN EVERMANN, A. M., PH. D., AND ALVIN SEALE, A. B.

Among the exhibits made by the U. S. Bureau of Insular Affairs at the Louisiana Purchase Exposition, held at St. Louis, Missouri, during the summer and fall of 1904, was a considerable collection of fishes from the Philippine Islands. This collection had been made under the direction of the Philippine government for the specific purpose mentioned. At the close of the exposition the authorities turned the entire collection over to the U. S. Bureau of Fisheries for study and report.

The localities represented in the collection are as follows:

San Fabian, Pangasinan, Luzon.—San Fabian is situated on the Gulf of Lingayen, about 100 miles north of Manila. The collection from this place was made by Mr. C. L. Hall and is a large and important one.

Bacon, Sorsogon, Luzon.—Sorsogon is the most southern province of Luzon. Bacon is situated in the northern part of the province, on Albay Inlet, in approximately latitude 13° 3′ north and longitude 124° east.

Bulan, Sorsogon, Luzon.—Bulan is on the west coast of Sorsogon, near the southern end of the province, approximately in latitude 12° 38′ north, longitude 123° 22′ east.

The collections from Bacon and Bulan are more extensive than any of the others. They were made by Prof. Charles J. Pierson, of Auburn, Nebraska, while a teacher in the Philippines.

Zamboanga, Mindanao.—Zamboanga, in the province of the same name, is at the extreme southern end of the western arm of Mindanao, in latitude 6° 54′ north and longitude 122° east. It is situated on the Strait of Basilan, about 500 miles south of Manila.

The specimens from this place were collected by Braulio Barbazo, who made also a small collection at Jolo, presumably on the island of Jolo.

The specimens were originally preserved in formalin in most cases, and afterwards transferred to alcohol. The excellent condition of most of the specimens in all of these collections indicates that the respective collectors did their work well and conscientiously, and the species represented show that the collecting was done intelligently and with proper discrimination. It is apparent that an intelligent and successful effort was made to have as many as possible of the important food fishes of the islands represented in the collections; and the large representation of the smaller, less conspicuous species evidences the fact that methods of collecting were employed such as are known only to the trained naturalist. In this way many specimens of more than usual scientific interest were secured.

The fish-fauna of the Philippines has been but little studied. Enough is known, however, to show that it is an exceedingly rich one. Not only is it rich in species, but many of the species are abundant in individuals; indeed, many species occur in great prodigality.

Although the native methods employed in the fisheries are primitive, the methods of preparing the products of the fisheries for use equally primitive, and methods of preserving the products are practically unknown, nevertheless fish food forms a large and important item in the diet of the inhabitants of the Philippines. The natural food resources of Philippine waters are believed to be enormous, embracing not only a great number of fishes, but many species of edible mollusks, crustaceans, and algæ, which as yet are scarcely recognized in the islands as fit for food. The development of these resources is a matter worthy the best efforts of the government. Effort should first be directed toward determining what the resources really are—what species of fishes and other aquatic animals and what aquatic plants occur, how abundant each is, its geographic distribution among the islands, and its life history, including its food and its enemies. The present paper is a contribution to that end.

The collections upon which this report is based embrace a total of nearly 2,500 specimens, representing 89 families, 139 genera, and 296 species, of which 2 genera and 22 species are believed to be new, and are here described.

It has not been deemed necessary to give full descriptions of any species except those believed to be new. Ordinarily attention has been called only to those characters which will prove useful in identifying the species. All the specimens bear tin-tag numbers, and these are printed in the report in order that each specimen may be fully authenticated. The first series of specimens, including the types of all the new species, is deposited in the U. S. National Museum. The first duplicate series has been sent to the government museum at Manila. The second duplicate series has been deposited in the museum of Stanford University, and the third in the reserve series of the U. S. Bureau of Fisheries.

The vernacular names, printed in italics, are those furnished by the collectors. Only such synonymy is given as is necessary to connect this report with works which a student of Philippine fishes must consult in studying these species. Usually the first reference to any particular publication is made complete; subsequent references to the same publication are made more brief. In synonymy the name of the locality from which each species was originally described is printed in heavy-face type; other locality references are printed in ordinary type and are in parentheses.

Two editions of the Histoire Naturelle des Poissons by Cuvier and Valenciennes were consulted, the octavo edition of 22 volumes and the quarto edition, also of 22

NOTE.—We take this opportunity to thank Prof. Charles J. Pierson, of Auburn, Nebraska, for the use of his field notes, and Messrs. Edmund Lee Goldsborough and Howard Walton Clark, of the Bureau of Fisheries, for assistance of various kinds in the preparation of this report. The accompanying illustrations are from drawings by Mr. A. H. Baldwin and Miss Annie Swift Buckelew. Those made by Miss Buckelew are figures 11, 12, 15, and 17.

volumes. The dates of publication of these two editions are identical, but the pagination is different. In our references we have given the page of each edition, that of the quarto edition (the one in our library) first, followed by that of the octavo edition in parenthesis. The bibliography at the end of the report lists the more important publications consulted.

Family ELOPIDÆ.

1. **Elops saurus** Linnæus.

One large specimen from Bulan (no. 4182; length 34 in.), agreeing in all essential respects with others from Florida.

Elops saurus Linnæus, Systema Naturæ, ed. XII, 518, 1766, **Carolina**; Günther, Catalogue Fishes British Museum, VII, 470, 1868; Day, Fishes of India, 649, pl. CLXVI, fig. 1, 1878; Jordan & Evermann, Fishes of North and Middle America, pt. I, 410, 1896 (Oct. 3); Jordan & Evermann, American Food and Game Fishes, 86, fig., 1902; Jordan & Evermann, Bull. U. S. Fish Comm., XXIII, pt. I, 1903 (1905), 53, fig. 8 (Honolulu).

2. **Megalops cyprinoides** (Broussonet). *Buan-buan.*

Three specimens from Bulan (no. 4151, 4153, and 4183; length 10.5 to 16.5 in.) and one from Tarlac (no. 4132; length 11 in.).

Clupea cyprinoides Broussonet, Ichth., I, pl. 9, 1782.
Megalops cyprinoides, Günther, Cat., VII, 471.

Family CHIROCENTRIDÆ.

3. **Chirocentrus dorab** (Forskål). *Botete.*

Three fine specimens from San Fabian (no. 4179, 4180, and 4181; length 15.2 to 16 in.) and one from Bacon (no. 3410; length 13.25 in.).

Clupea dorab Forskål, Descr. Anim., 72, 1775, **Red Sea.**
Chirocentrus dorab, Günther, Cat., VII, 475; Day, Fishes India, 652, pl. CLXVI, fig. 3.

Family CLUPEIDÆ.

4. **Stolephorus delicatulus** (Bennett).

Two hundred and fifteen specimens from Bacon (no. 3915, 3502, 4080, and 4009; length 1.5 to 2.75 in.) and five from Bulan (no. 3756; length 2.75 in.).

Clupea delicatula Bennett, Proc. Comm. Zool. Soc. London, I, 168, 1831, **Mauritius.**
Spratelloides delicatula, Günther, Cat., VII, 464.

5. **Stolephorus gracilis** (Temminck & Schlegel).

Three specimens from Bacon (no. 3768 and 3501; length 1 to 2.2 in.).

This species (with dorsal 11 and anal 13) can not be identical with *Atherina japonica* Houttuyn (with dorsal 17 and anal 22 or 23) as suggested by Dr. Jordan.

Clupea gracilis Temminck & Schlegel, Fauna Japonica, Pisces, 238, pl. CVIII, fig. 2, 1842, **Japan.**
Spratelloides gracilis, Günther, Cat., VII, 465.

6. **Harengula moluccensis** Bleeker.

Ten specimens from Bacon (no. 3606 to 3609 3449 to 3551, 4026 and 4027, and 3932; length 4.2 to 5.75 in.) and 8 from Bulan (no. 3426 to 3432 and 3893; length 4.1 to 5.25 in.).

The base of the ventrals is under the middle of the dorsal, whose origin is much nearer tip of snout than to base of caudal, or midway between tip of snout and base of last anal ray. In Bleeker's figure of this species the ventrals are shown too far forward, as he explains in the text.

Harengula moluccensis Bleeker, Nat. Tijds. Ned. Ind., IV, 1853, 609, **Ternate; Amboyna**; Günther, Cat., VII, 427.

7. **Sardinella clupeoides** (Bleeker).

One specimen from Bulan (no. 3243; length 8.75 in.), agreeing well with Bleeker's figure.

Amblygaster clupeoides Bleeker, Journ. Ind. Archipel., 73, 1849, **Macassar, Celebes**; Bleeker, Atlas, vi, 103, pl. cclxxii, fig. 1.
Clupea clupeoides, Günther, Cat., vii, 425.

8. **Sardinella perforata** (Cantor).

Twelve specimens from Bacon (no. 3658 to 3669; length 4.5 to 5.5 in.), agreeing perfectly with Bleeker's figure and description.

Clupeonia perforata Cantor, Cat. Malayan Fishes, 294, 1850, **Sea of Pinang.**
Spratella kowala Bleeker, Haringachtige Visschen, 28, Verh. Bat. Gen., xxiv, 1852, **Batavia.**
Clupea perforata, Günther, Cat., vii, 424.

9. **Ilisha hœvenii** (Bleeker). *Tubac.*

One specimen from San Fabian (no. 4127; length 6.5 in.).

Pellowa hœvenii Bleeker, Haringachtige Visschen, 21, Verh. Bat. Gen., xxiv, 1852, **Batavia**; Günther, Cat., vii, 455.
Ilisha hœvenii Bleeker, Atlas, vi, 117, pl. cclxix, fig. 2.

Family DOROSOMATIDÆ.

10. **Konosirus thrissa** (Linnæus).

Three fine specimens (no. 4170 to 4172; length 8 to 8.5 in.), without definite locality. Last dorsal ray extending to base of caudal.

Clupea thrissa Osbeck, Reise nach Ostindien und China, 336, 1765; Linnæus, Syst. Nat., ed. x, 318, 1758.
Clupea nasus Bloch, Ichth., xii, pl. ccccxxix, fig. 1, 1797.
Chatoessus nasus, Günther, Cat., vii, 407.
Dorosoma nasus, Bleeker, Atlas, vi, 142, pl. cclx, fig. 4.

11. **Anodontostoma chacunda** (Buchanan-Hamilton). *Cabashi.*

Two fine specimens from Bacon (no. 3231 and 3232; length 6.1 and 7.1 in.). This species lacks the dorsal filament.

Clupanodon chacunda Buchanan-Hamilton, Fish. Ganges, 246, 1822, **Ganges River.**
Chatoessus chacunda, Günther, Cat., vii, 411.
Chatoessus selangkat Bleeker, Haringachtige Visschen, 47, Verh. Bat. Gen., xxiv, **Batavia.**
Dorosoma chacunda, Bleeker, Atlas, vi, pl. cclxi, figs. 5 (var. *selangkat*) and 6.

Family ENGRAULIDÆ.

12. **Anchovia indica** (Van Hasselt).

Ten specimens from Bulan (no. 3989 and 3973; length 3.5 to 5.2 in.).

Engraulis indicus Van Hasselt, Algem. Konst-Letterbode, 329, 1823.
Engraulis russellii, Günther, Cat., vii, 390.
Stolephorus indicus, Bleeker, Atlas, vi, 127, pl. cclix, fig. 2.

Family SYNODONTIDÆ.

13. **Saurida argyrophanes** (Richardson). *Bitilla.*

Two specimens from San Fabian (no. 3673 and 3674; length 7.1 and 7.75 in.) and one from Zamboanga (No. 4083; length 7.5 in.).

Saurus argyrophanes Richardson, Ichth. Chin., in Rept. Brit. Assoc., xv, 1845, 302.
Saurida argyrophanes, Günther, Cat., v, 400, 1864.
Aulopus elongatus Temminck & Schlegel, Fauna Japonica, Pisces, 233, pl. cv, fig. 2, 1846.

14. **Saurida gracilis** (Quoy & Gaimard).

Three specimens from Bacon (no. 3983, 3984 and 3986; length 4.75 in.).

Saurus gracilis Quoy & Gaimard, Voy. Uran., Zool., 224, 1824, **Sandwich Islands.**
Saurida nebulosus, Günther, Cat., v, 399; Bleeker, Atlas, vi, 156, pl. cclxxvii, fig. 1.
Saurida gracilis, Jordan & Evermann, Bull. U. S. Fish Comm., xxiii, pt. 1, 1903 (1905), 65 (Hilo and Honolulu).

15. **Trachinocephalus myops** (Forster).

One specimen from Bulan (no. 4129; length 8 in.).

Salmo myops Forster in Bloch & Schneider, Syst. Ichth., 421, 1801, **St. Helena.**
Saurus myops, Günther, Cat., v, 398.
Trachinocephalus myops, Jordan & Evermann, Bull. U. S. Fish Comm., xxiii, 1903 (1905), 62, fig. 13 (Hilo and Honolulu).

16. **Synodus varius** (Lacépède).

Two specimens from Bulan (no. 3670 and 3671; length 7 and 7.25 in.) and one from Bacon (no. 3982; length 4 in.).

Salmo varius Lacépède, Hist. Nat. Poiss., v, 224, pl. 3, fig. 3, 1803, **Ile de France.**
Saurus varius, Günther, Cat., v, 395; in part.
Synodus varius, Jordan & Evermann, Bull. U. S. Fish Comm., xxiii, pt. 1, 1903 (1905), 63, pl. ii and fig. 14 (Hilo and Honolulu).

Family MYCTOPHIDÆ.

17. **Myctophum gilberti** Evermann & Seale, new species.

Head 3.5 in length; depth 4.5; eye 3 in head; dorsal xii; anal 16; snout 2 in eye; interorbital 1.5; scales large, thin, smooth, deciduous, 30 in lateral line.

Body oblong, compressed, the forehead evenly rounded; lower jaw extending slightly beyond upper; depth of caudal peduncle 3 in head, equal to diameter of eye; maxillary equal to postocular part of head, its distal end extending beyond eye a distance equal to one-half of orbit; mandible 1.7 in head; mouth oblique.

Teeth on jaws and palatines in narrow bands; no teeth on vomer; bands of teeth on mesopterygoids; 16 developed gillrakers on lower limb of first gill-arch, the longest 2 in eye.

Arrangement of photophores: Caudal 2, one at middle of caudal base, the other at origin of lowest caudal ray; posteroanals 4; anteroanals 6, the anterior one slightly separated from its fellows; ventrals 4, the anterior one in axil of ventral fin; thoracics 3; pectorals 3, in form of a triangle; mandibular 3; opercular 2; posterolateral 1, very near lateral line and vertically on a line between interspace of anal photophores and base of adipose dorsal; mediolaterals 3, forming a very obtuse triangle, the upper one very near lateral line, the lower one midway between lateral line and origin of anal fin, a little too far front to form a true oblique line from posterior mediolateral to posterior ventral photophore, the anterior one on a horizontal line with the last and vertically over the posterior margin of second ventral; anterolateral 1, just above middle of pectoral fin and on first scale below lateral line.

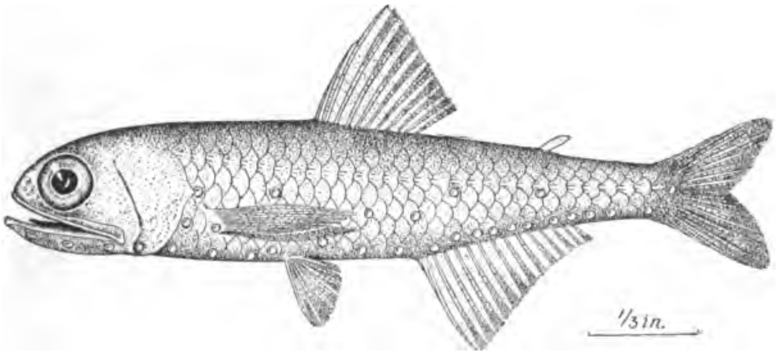

FIG. 1.—*Myctophum gilberti* Evermann & Seale, new species. Type.

Origin of dorsal fin midway between tip of snout and posterior anal photophore, the longest ray equal in length to distance from pupil to posterior margin of opercle; origin of adipose dorsal midway between posterior axil of dorsal and base of caudal; origin of anal midway between anterior thoracic photophore and lower caudal photophore, directly below axil of dorsal, its longest ray 1.5 in head; ventrals 2.5 in head, their origin below seventh scale of lateral line; pectoral long, 1.4 in head, tip extending to anterior mediolateral photophore; caudal forked, about 1.75 in head (mutilated).

Color in spirits, yellowish white; base of dorsal black; a black area at upper margin of opercle; a dusky band on anterior third of mandible; base of caudal and top of caudal peduncle dusky.

This species seems most nearly related to *M. reinhardtii* Lütken.

Four specimens from Bulan, length 2.1 to 2.5 in. Type (field no. 3841) no. 55900, U. S. National Museum; length 2.5 in., from Bulan, Sorsogon; coll. Charles J. Pierson. Of the 3 cotypes, 1 (field no. 3841) is no. 20,000, Stanford Univ. Mus.; another (field no. 3841) is in Museum at Manila, and a third (field no. 3841) is no. 4535, U. S. Bureau of Fisheries. Named for Dr. Charles H. Gilbert.

Family ANGUILLIDÆ.

18. **Anguilla mauritiana** Bennett. *Pabucang-binhi.*

One fine specimen from Tarlac (no. 4063; length 23 in.).

Anguilla mauritiana Bennett, Proc. Comm. Zool. Soc. Lond. 1831, 128, **Mauritius.**
Muræna manillensis Bleeker, Atlas, VI, 10, pl. CLXXXVIII, fig. 2, **Manila, Luzon.**
Anguilla mauritiana, Günther, Cat., VIII, 25.

Family MURÆNIDÆ.

19. **Gymnothorax richardsoni** (Bleeker).

One small specimen from San Fabian (no. 3842; length 5.2 in.).

Muræna richardsoni Bleeker, Nat. Tijds. Ned. Ind., III, 1852, 296, **Wahai, Ceram**; Günther, Cat., VIII, 118.

20. **Gymnothorax afer** Bloch.

One specimen from Bacon (no. 3769; length 2.5 in.), which we refer doubtfully to this species.

Gymnothorax afer Bloch, Ichth., XII, 73, pl. CCCCXVII, 1797.
Muræna afra, Günther, Cat., VIII, 123.

Family PLOTOSIDÆ.

21. **Plotosus anguillaris** (Bloch). *Sumbilang.*

Eleven specimens from Jolo (no. 3352 to 3357 and 3421 to 3425; length 5 to 7 in.), eleven fine specimens from Bacon (no. 3365 to 3368, 3475 to 3480 and 4034; length 5.1 to 7 in.), and 48 young from Bacon (no. 4031; length, 1 to 1.5 in.).

Platystacus anguillaris Bloch, Ichth., XI, 49, pl. CCCLXXI, fig. 1, 1797.
Plotosus anguillaris, Günther, Cat., V, 24.

Family SILURIDÆ.

22. **Netuma thalassinus** (Rüppell). *Tabomomo.*

One specimen from San Fabian (no. 3244; length 8 in.), three large specimens from Bulan (no. 4186, 4187, and 4188; length 19 to 20 in.); two small specimens from "Philippine Islands," without local label (no. 3939; length 3.5 and 5 in.).

Bagrus thalassinus Rüppell, Neue Wirb., Fische, 75, pl. 20, fig. 2, 1837, **Massaua.**
Arius thalassinus, Günther, Cat., V, 139.

Family FISTULARIIDÆ.

23. **Fistularia petimba** Lacépède. *Droal.*

Two specimens, one from San Fabian (no. 3407; length 15 in.), and one from Bacon (no. 4189; length 8.25 in.).

Fistularia petimba Lacépède, Hist. Nat. Poiss., V, 349, 1803, **New Britain, Reunion Island**; Jordan & Evermann, Bull. U. S. Fish. Comm., XXIII, 1903 (1905), 116 (Honolulu, Hilo, Kailua, Necker Island, and Hanalei Bay, Kauai; also Japan, Samoa, Philippines, and Papeete, Tahiti).

24. **Fistularia serrata** Cuvier. *Sivisivi.*

Three young from Bacon (no. 3984; length 9 to 12 in.).

Fistularia serrata Cuvier, Règne Anim., ed. I, vol. II, 349, 1817, America; Günther, Cat., III, 533; Jordan & Evermann, Bull. U. S. Fish. Comm., XXIII, pt. 1, 1903 (1905), 116 (Honolulu).

Family CENTRISCIDÆ.

25. **Aeoliscus strigatus** (Günther).

Two specimens from Bacon (no. 3943; length 4.75 and 5 in.).

Amphisile strigata Günther, Cat., III, 528, Java.

Family SYNGNATHIDÆ.

26. **Gasterotokeus biaculeatus** (Bloch).

Fifteen specimens from Bacon (no. 3447 to 3451, 3505 to 3508, 3597 to 3599, 3600, 3601, 3991, and 4190; length 5.25 to 9.25 in.).

With the exception of no. 4190, these specimens are all pale green, with a more or less distinct dark stripe through the eye. The body is depressed, the dorsal surface of middle body ring being at least 2.5 in ventral, differing in this respect from specimen no. 4190, which is described as follows:

Head 5.2 in length; depth 5.1 in head, the greatest width of body 3.25 in head; snout 1.75; width of snout at middle one-third less than its depth; eye 4.5 in snout; interorbital 5.75; dorsal 41; rings 17+40; dorsal fin on anterior 10 caudal rings; anal opening on anterior caudal ring; origin of dorsal midway between tip of tail and nostril; tail prehensile, no caudal fin; body elongate, depressed, the ventral surface twice as wide as dorsal; plates without spines; pectoral 5.75 in head. Color greenish; snout with 2 indistinct greenish bands.

Syngnathus biaculeatus Bloch, Ichth., IV, pl. CXXI, figs. 1 and 2, 1797, no locality given.
Gasterotokeus biaculeatus, Günther, Cat., VIII, 194; Day, Fishes India, 681, pl. CLXXIV, fig. 5.

27. **Corythroichthys eleræ** Evermann & Seale, new species.

Head 7.2 in length; snout 2; eye 2.5 in snout; dorsal 29; rings 16+36; a single ridge across cheek; interorbital 1.75 in eye; snout cylindrical, its depth and width being equal; lower surface of head and ventral surface of snout forming a straight line; depth of body greater than its width; length of body including head 1.45 in length of tail without caudal; a distinct nuchal ridge with 2 deep scallops; upper lateral margin of plates projecting, forming a scalloped margin on side of back; ventral surface of body rounded, dorsal surface concave; vent one ring in front of origin of dorsal; dorsal fin on anterior 6 rings of tail; origin of dorsal midway between tip of snout and twenty-fifth ring of tail; height of dorsal fin equal to depth of body at middle of fin; pectoral 14, its length 4.75 in head; caudal 2.2 in snout; anal rays 3, inconspicuous.

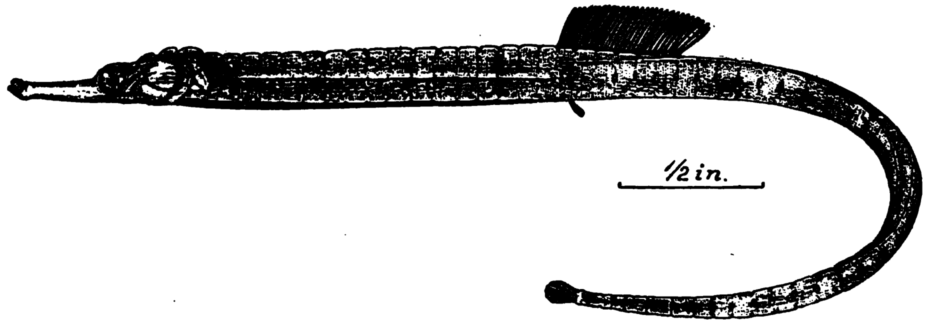

FIG. 2.—*Corythroichthys eleræ* Evermann & Seale, new species. Type.

Color in spirits, pale green, with blotches of darker green on side; 3 black cross-bands on under part of thorax; some fine dark longitudinal lines on opercle, 3 on under part of head; no dark lines through eye; snout with about 5 indistinct bands of dots; a dusky blotch on base of pectoral (not always present); dorsal unmarked.

Very near *C. conspicullatus* (Jenyns), but with longer snout, more posterior dorsal and the dorsal scales more roughened.

Eight specimens from Bacon (no. 3898 and 3944; length 4.2 to 4.75 in.).

Type (field no. 3944), no. 55908, U. S. National Museum, 4.75 in. in length, from Bacon, Sorsogon: collected by Chas. J. Pierson. Of the cotypes, each bearing field no. 3898, one is no. 20001, Stanford University Museum; another is no. 4536, U. S. Bureau of Fisheries, and one each is in the museum at Manila, the Philadelphia Academy of Natural Sciences, the U. S. National Museum, the Museum of Comparative Zoology, the Indiana University Museum, and the Field Museum of Natural History.

Family BELONIDÆ.

28. **Tylosurus giganteus** (Temminck & Schlegel).

Five specimens from Bacon (no. 3697, 3698, and 3378 to 3380; length 8.75 to 12 in.). These agree well with specimens from Hawaii.

Belone gigantea Temminck & Schlegel, Fauna Japonica, Pisces, 245, 1846, **Nagasaki.**
Belone annulata, Günther, Cat., vi, 240.
Tylosurus giganteus, Jordan & Evermann, Bull. U. S. Fish Comm., xxiii, pt. 1, 1903 (1905), 124, fig. 30 (Honolulu).

29. **Tylosurus leiuroides** (Bleeker).

One specimen from Bacon (no. 3519; length 11.25 in.); dorsal 21; anal 21.

Distinguished by the long nose and low dorsal fin.

Belone leiuroides Bleeker, Nat. Tijds. Ned. Ind., i, 1850, 479, **Billiton;** Günther, Cat., vi, 243.

Family EXOCŒTIDÆ.

30. **Hyporhamphus quoyi** (Cuvier & Valenciennes).

Three specimens from Bacon (no. 3460, 3617, and 3618; length 7 to 9.1 in.).

These agree well with Bleeker's figure.

Hemiramphus quoyi Cuvier & Valenciennes, Hist. Nat. Poiss., xix, 26 (35), **New Guinea;** Günther, Cat., vi, 267; Bleeker, Atlas, vi, 57, pl. ccl, fig. 3.

31. **Hyporhamphus dussumierii** (Cuvier & Valenciennes).

Four specimens from Bacon (no. 4005 and 3962; length 2.25 to 4.5 in.), and one from Bulan (no. 3739; length 10 in.).

We have compared these specimens with others from Samoa identified by Jordan and Seale as *H. affinis* and find them indistinguishable, and we regard *H. affinis* Günther as a synonym of *H. dussumierii.*

Hemiramphus dussumerii Cuvier & Valenciennes, Hist. Nat. Poiss., xix, 24 (33), pl. 554, **Seychelles;** Günther, Cat., vi, 266.

32. **Hemiramphus marginatus** (Forskål).

Four fine specimens from Bacon (no. 4160 to 4163; length 10 in.) agreeing with Bleeker's figure.

Esox marginatus Forskål, Descr. Anim., 57, 1775, **Red Sea.**
Hemirhamphus marginatus, Günther, Cat., vi, 270; Bleeker, Atlas, vi, 54, pl. ccliv, fig. 4.

33. **Cypsilurus simus** (Cuvier & Valenciennes).

Two specimens from Bacon (no. 3308 and 3309; length 6.5 and 6.75 in.), two from Bulan (no. 3202 and 3203; length 9.2 and 9.75 in.), and one from the "Philippines," no definite label (no. 4164; length 9.3 in.). We have compared these with examples from Honolulu and find them to agree perfectly.

Exocœtus simus Cuvier & Valenciennes, Hist. Nat. Poiss., xix, 77 (105), **Hawaiian Islands.**
Cypsilurus simus, Jordan & Evermann, Bull. U. S. Fish Comm., xxiii, pt. 1, 1903 (1905), 134, fig. 46 (Honolulu; Waimea and Hanamaulu Bay, Kauai; and Napili, Molokai).

34. **Zenarchopterus dispar** (Cuvier & Valenciennes).

One specimen, without lower jaw, and with mutilated caudal, probably belonging to this species, from Bacon (no. 4008; length, without bill, 4.5 in.). Dorsal XII; anal 11; scales 40.

Hemiramphus dispar Cuvier & Valenciennes, Hist. Nat. Poiss., XIX, 42 (58), pl. 558, 1846, **Java**; Günther, Cat., VI, 274.
Zenarchopterus dispar, Bleeker, Atlas, VI, 63, pl. CCLIII, fig. 4.

35. **Zenarchopterus philippinus** Peters.

Forty-nine specimens from Bacon (no. 3384; length 3.5 to 4.5 in.). Dorsal 14; anal 15; head 1.5 in length; lower jaw 4.5 in head; scales 46; caudal forked.

Hemirhamphus (Zenarchopterus) philippinus Peters, Monatsb. Kön. Akad. Wiss. Berlin 1868, 273, **Luzon**.
Zenarchopterus philippinus, Bleeker, Atlas, VI, 63.

Family ATHERINIDÆ.

36. **Atherina temminckii** Bleeker.

Two specimens from Bulan (no. 3997; length 2.5 and 3.5 in.), and one from Bacon (no. 3751; length 3 in.).

Head 4 in length; depth 6.3; eye 2.8 in head; snout 4.1; interorbital 3; dorsal VI-I, 9; anal 12.

Atherina temminckii Bleeker, Nat. Tijds. Ned. Ind., V, 1853, 506, **Batavia**; Jordan & Seale, Proc. U. S. National Museum, XXVIII, 1905, 774 (Negros).

37. **Atherina lacunosa** Forster.

Five specimens from Bacon (no. 3961; length 2.75 to 3.75 in.).

Head 3.8 in length without caudal; depth 4.6; eye 2.75 in head; snout 4.5; interorbital 3; dorsal V-I, 10; anal I, 13; scales 41–7; maxillary reaching vertical at anterior edge of pupil; origin of spinous dorsal slightly nearer anal than insertion of ventrals; no dark blotch on pectoral.

Atherina lacunosa Forster, Descr. Anim., 298, 1774, **New Caledonia**; probably not of Günther.

38. **Atherina forskalii** Rüppell.

Eighteen specimens from Bulan (no. 3833; length 2.1 to 3.2 in.), and 53 specimens from Bacon (no. 3653 and 3892; length 2 to 3.5 in.).

Atherina forskalii Rüppell, Neue Wirb., Fische, 132, pl. 33, fig. 1, 1835, **Belama**; Günther, Cat., III, 397; Day, Fishes India, 345, pl. LXXI, fig. 4.

Family MUGILIDÆ.

39. **Mugil sundanensis** Bleeker.

Nine specimens from Bacon (no. 3643 to 3651; length 4 to 6.2 in.).

Mugil sundanensis Bleeker, Nat. Tijds. Ned. Ind., IV, 265, **Sumatra**; Günther, Cat., III, 425.

40. **Mugil planiceps** Cuvier & Valenciennes.

Five specimens from Bulan (no. 3710 to 3714; length 6.5 to 8.75 in.).

Mugil planiceps Cuvier & Valenciennes, Hist. Nat. Poiss., XI, 90 (122) **Calcutta**; Günther, Cat., III, 428.

Family SPHYRÆNIDÆ.

41. **Sphyræna jello** Cuvier & Valenciennes.

Three specimens from Bacon (no. 4175 to 4177; length 13 to 14 in.) and 2 from Bulan (no. 4152 and 4153; length 16.35 and 19.5 in.). No. 4175 to 4177 are referred to this species with some doubt, as they are in such bad condition as to make the scale counts impossible, but in other respects they agree with *S. jello*.

Head 3.5 in length; depth 7.5; eye 6.4 in head; snout 2.1; interorbital 4.75; scales 16–130–20.

Sphyræna jello Cuvier & Valenciennes, Hist. Nat. Poiss., III, 258 (349), 1829, **Vizagapatam**; Günther, Cat., II, 337; Day, Fishes India, 342.

42. **Sphyræna obtusata** Cuvier & Valenciennes. *Dumbusan.*

One specimen from Bulan (no. 3411; length 7.5 in.). Head 3.1 in length; depth 6.1; eye 4.5 in head; snout 2.34.

Sphyræna obtusata Cuvier & Valenciennes, Hist. Nat. Poiss., III, 258 (350), Pondicherry; Günther, Cat., II, 339; Day, Fishes India, 343, pl. LXXI, fig. 5.

43. **Sphyræna langsar** Bleeker. *Domosot.*

One specimen from Bulan (no. 3412; length 8 in.), one from Bacon (no. 3942; length 5.5 in.), and 3 from San Fabian (no. 3677 and 4022; length 2.75 to 4.75 in.). These each have 75 scales in lateral line. This species is distinguished from *S. obtusata* by the longer snout and smaller scales.

Sphyræna langsar Bleeker, Nat. Tijds. Ned. Ind., VII, 367, Batjan; Günther, Cat., II, 340.

Family HOLOCENTRIDÆ.

44. **Myripristis pralinius** Cuvier & Valenciennes.

Two specimens from Bacon (no. 3223 and 3228; length 6.1 and 6.2 in.). These specimens show 6 indistinct yellowish longitudinal stripes below the lateral line. Depth 2.45 in length; head 3.25; eye 2 in head; snout 6.75; scales 4–38–6; dorsal X–I, 15; anal IV, 14; eye 6.1 in head; snout 3.5 in eye; large blunt projecting teeth in each jaw.

Myripristis pralinius Cuvier & Valenciennes, Hist. Nat. Poiss., III, 127 (170) and VII, 366 (486), New Ireland.
Myripristis bleekeri Günther, Cat., I, 20, 1859, Sea of Banda Neira; not *M. pralinius* of Günther.

45. **Myripristis microphthalmus** Bleeker.

Two specimens from Bacon (no. 3250 and 3723; length 7.25 and 7.5 in.) and one from Bulan (no. 3966; length 5 in.).

Head 3.25 in length; depth 2.45; eye 7 in head; scales 4–29–6; dorsal X–I, 14; anal IV, 12. These specimens agree well with others from Samoa.

Myripristis microphthalmus Bleeker, Nat. Tijds. Ned. Ind., III, 261, 1852, Amboyna; Atlas, IX, pl. CCCLVIII, fig. 2; Günther, Cat., I, 24.

46. **Myripristis murdjan** (Forskål).

Three specimens from Bacon (no. 3235, 3227 and 3637; length 6.25 to 8 in.), agreeing with Hawaiian specimens.

Sciæna murdjan Forskål, Descr. Anim., 48, 1775, Djidda, Red Sea..
Myripristis murdjan, Jordan & Evermann, Bull. U. S. Fish Comm., XXIII, pt. 1, 1903 (1905), 157, pl. V (Honolulu, Hilo, Kailua, Laysan, and Samoa).

47. **Myripristis macrolepis** Bleeker. *Baga-baga.*

One specimen (no. 3363; length 5.75 in.), from Zamboanga.

Head 3 in length; depth 2.3; eye 2.01 in head; snout 3 in eye; interorbital 3.75 in head; dorsal X–I, 15; anal IV, 12; scales 3–29–5, 6 scales in front of dorsal; maxillary 1.75 in head, its distal end under posterior margin of pupil.

Myripristis macrolepis Bleeker, Atlas, IX, pl. CCCLIX, fig. 3.

48. **Holocentrus cornutus** Bleeker.

One specimen from Bacon (no. 6919; length 5.25 in.) and one from Bulan (no. 6928; length 6.75 in.).

Head 3.2 in length; depth 2.8; eye 2.55 in head; snout 1.5; maxillary 3; mandible 2; scales 3–37–5; dorsal XI, 13; anal IV, 9, the fourth spine very long, nearly equal to head.

Color in spirits, yellowish, with dark longitudinal lines, the third from dorsal terminating in a dark caudal spot; membranes of spinous dorsal dark, first webs of anal black; outer margins of caudal dark.

Holocentrum cornutum Bleeker, Nat. Tijds. Ned. Ind., V, 240, Ceram; Günther, Cat., I, 45.

Family SCOMBRIDÆ.

49. **Scomber brachysomus** Bleeker. *Masangui.*

One specimen from San Fabian (no. 3271; length 8.1 in.).

Gillrakers equal to distance from tip of snout to orbit, shorter than in *S. microlepidotus*, from which this species is easily distinguished by the deeper body.

Scomber brachysoma Bleeker, Nat. Tijds. Ned. Ind., I, 356, 1850, **Batavia**; Günther, Cat., II, 361; Day, Fishes India, 251.

50. **Scomber microlepidotus** Rüppell.

Two specimens from Bacon (no. 4173 and 4174; length 10 and 10.25 in.). Gillrakers long, equal to distance from tip of snout to middle of eye.

Scomber microlepidotus Rüppell, Neue Wirb., Fische, 38, pl. XI, fig. 2, 1837, **Red Sea**; Günther, Cat., II, 361; Day, Fishes India, 250, pl. LIV, figs. 3, 4, and 5; Fowler, Proc. Ac. Nat. Sci. Phila. 1904, 759.

51. **Scomber japonicus** Houttuyn.

One specimen from Bulan (no. 3912; length 5.45 in.). Blue above, silvery below. Head 3.25 in length; depth 5.2; dorsal IX, 12+V; anal II, 11+V.

This species is indistinguishable from the common chub mackerel (*S. colias*) of the Atlantic.

Scomber japonicus Houttuyn, Verh. Holl. Maat. Weet. Haarl., XX, 1782, 331, **Japan**; Jordan & Evermann, Bull. U. S. Fish Comm., XXIII, pt. 1, 1903 (1905), 169, fig. 62.

52. **Gymnosarda pelamis** (Linnæus).

Two specimens from Bulan (no. 4184 and 4185; length 15 and 15.25 in.). Dorsal XVI—12+VIII; anal II—12+VII.

Scomber pelamis Linnæus, Syst. Nat., ed. X, 297, 1758, "**in pelago inter Tropicos.**"
Thynnus pelamys, Günther, Cat., II, 364.
Gymnosarda pelamis, Jordan & Evermann, Bull. U. S. Fish Comm., XXIII, pt. 1, 1903 (1905), 172, fig. 64.

53. **Rachycentron canadus** (Linnæus).

One fine specimen from Bulan (no. 4151; length 24 in.). Head 4.05 in length; depth 6.3; eye 7.1 in head; snout 2.5; maxillary 2.5; scales about 332; dorsal VIII, 32; anal 27; lateral line with several strong sharp curves.

Gasterosteus canadus Linnæus, Syst. Nat., ed. XII, 491, 1766, **Carolina**.
Scomber niger Bloch, Ichth., X, 48, pl. CCCXXXVII, 1797.
Elacate pondiceriana Cuvier & Valenciennes, Hist. Nat. Poiss., VIII, 241 (329), 1831, **Pondicherry**.
Elacate niger, Günther, Cat., II, 375.
Rachycentron canadus, Jordan & Evermann, Fishes North and Mid. Amer., 948, pl. CXLVIII, fig. 401, 1896.

NESOGRAMMUS Evermann & Seale, new genus.

Nesogrammus Evermann & Seale, new genus of Scombridæ (*Nesogrammus piersoni*).

Body long and slender, completely covered with small, thin, deciduous scales; no corselet; lateral lines 2, the lower branch leaving the main lateral line under the base of third or fourth dorsal spine, from which point it extends nearly vertically downward to lower third of side, along which it runs, approximately parallel to the ventral line of body, to caudal peduncle. Ventrals I, 5; dorsal and anal finlets 7. Villiform teeth on vomer, palatines, and tongue; a single row of sharp, canine-like teeth in each jaw.

This genus is related to *Scomberomorus*, from which it differs, however, in the presence of two lateral lines and in the complete squamation of the body. (*νησος*, island; *γραμμα*, line.)

54. **Nesogrammus piersoni** Evermann & Seale, new species.

Head 4.5 in length; depth 4.75; eye 4.35 in head; snout 2.85; maxillary 2.25; mandible 1.9; dorsal XII+I, 9+VII; pectoral 1.9; ventral 3.2; anal I, 11+VII; scales 170 in upper and 145 in lower branch of lateral line.

Body elongate, moderately compressed; depth of caudal peduncle 1.9 in snout; head pointed; jaws equal; interorbital space flat, its width greater than eye; mouth large; maxillary slipping under preorbital and ending under anterior third of eye, its distal end formed by the supplemental bone, pointed and directed slightly upward; base of mandible under middle of eye; teeth in jaws in a single row, rather strong, triangular, about 14 to 17 on each side; minute teeth on vomer, palatines, and tongue; gillrakers rather bluntly pointed, 15 on lower limb, the longest 3 in snout; opercle and preopercle entire, the posterior margin of preopercle with a wide anterior curve in its middle portion; cheek and opercle with fine scales; body entirely covered with fine, thin deciduous scales; lateral lines 2, the upper beginning at upper edge of opercular opening and running approximately parallel with the back to below the sixth dorsal finlet, where it curves downward and unites with the lower branch; lower branch originating under base of third dorsal spine, running nearly vertically downward to level of lower edge of pectoral, where it curves backward and extends along lower third of side to middle of caudal peduncle, where it again unites with the upper branch; no corselet; breast scaled; caudal peduncle with a median keel and a smaller one above and below it.

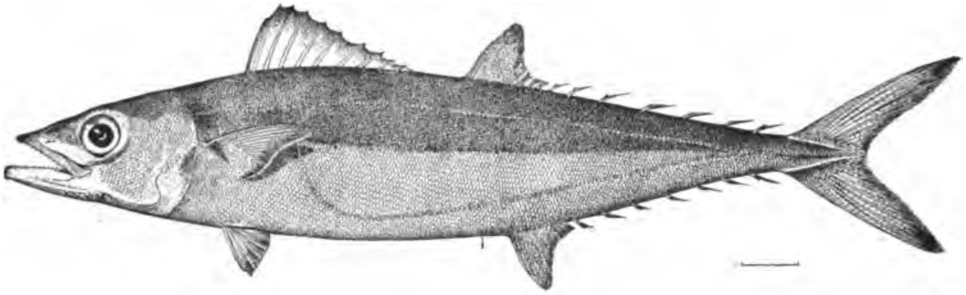

FIG. 3.—*Nesogrammus piersoni* Evermann & Seale, new species. Type.

Origin of spinous dorsal midway between tip of snout and third ray of soft dorsal; dorsal spines connected, except the 2 posterior ones, which do not protrude, the longest spine 2.75 in head, the 2 dorsals entirely separate; origin of soft dorsal slightly in advance of vent, its longest ray 2.75 in head; dorsal finlets 7; origin of anal midway between base of caudal and origin of ventrals, its longest ray 3.75 in head; anal finlets 7; no free spines in front of anal; origin of ventrals below axil of pectoral, their length 3 in head; caudal deeply forked.

Color in spirits, brownish above, silvery below; a large dusky blotch at origin of lateral line and in axil of pectoral; top of snout dusky; a dusky area through eye; membranes of spinous dorsal dusky; ventrals darker on posterior third; other fins with very slight wash of dusky.

One specimen (field no. 4178), the type, no. 55899, U. S. National Museum, 16 inches long, from Bulan, Sorsogon, P. I.; collected by Prof. Charles J. Pierson, for whom the species is named.

Family TRICHIURIDÆ.

55. **Trichiurus haumela** (Forskål). *Pinka.*

Head 7.5 in length; depth 14; eye 6.1 in head, 2 in snout; interorbital 2.5 in snout; dorsal 129; anal represented by 106 minute spines; teeth large, 18 in upper jaw, 20 in lower; no teeth on vomer, a few minute teeth on palatines; gillrakers consisting of small, sharp spines, about 14 on lower limb.

Color in spirits, silvery, bluish above; 2 bright yellow longitudinal stripes on lower half of body; dorsal yellow, with dusky margin.

One specimen from San Fabian (no. 3381; length 19.75 in.).

Clupea haumela Forskål, Descr. Anim., 72, 1775, **Red Sea.**
Trichiurus haumela, Günther, Cat., II, 348 (Malayan Peninsula; Amboyna).

Family CARANGIDÆ.

56. **Scomberoides toloo-parah** (Rüppell). *Cassisung.*

Two specimens from San Fabian (no. 3716 and 3717; length 6.25 and 6.5 in.).

Lichia toloo-parah Rüppell, Atlas, Fische, 91, 1828, **Massowah, Red Sea.**
Chorinemus toloo, Günther, Cat., II, 473.

57. **Decapterus macrosomus** Bleeker.

Twelve specimens from Bulan (No. 3345, 3347 to 3349, 3351, 3521, 3522, 3524, and 3531 to 3534; length 5.75 to 8 in.) and one from Bacon (no. 4146; length 6 in.).

Depth 5.5; head 3.75; about 59 plates or scales in straight portion of lateral line; origin of ventrals nearer to tip of snout than to anal. This fish is more elongate and has smaller plates than has *D. kurra*, and the distance between tips of ventrals and origin of anal is 1.5 in head, while in *D. kurra* it is much less, being about 2.5.

Decapterus macrosoma Bleeker, Nat. Tijds. Ned. Ind., I, 358, 1850, **Batavia.**
Caranx macrosoma, Günther, Cat., II, 425.

58. **Decapterus kurra** Bleeker.

Six specimens from Bulan (no. 3350, 3346, 3911, 3913, 3914, and 3523; length 4 to 6 in.)

Head 3 in length; depth 4.5; plates 40; distance between tips of ventrals and origin of anal short, about 2.5 in head; origin of ventrals nearer origin of anal than to tip of snout.

Decapterus kurra Bleeker, Makreelachtige Visschen, 50, Verh. Bat. Gen., XXIV, 1852, **Batavia.**
Caranx kurra, Günther, Cat., II, 427; Day, Fishes India, 214, pl. LXVIII, fig. 5.

59. **Seriola nigrofasciata** (Rüppell).

One specimen from Bulan (no. 3602; length 6.2 in.)

Nomeus nigrofasciatus Rüppell, Atlas, Fische, 92, pl. 24, fig. 2, 1828, **Red Sea.**
Seriola nigrofasciata, Günther, Cat., II, 465.

60. **Lactarius lactarius** (Bloch & Schneider). *Bog-snag-taen.*

Three fine specimens from San Fabian (no. 3274, 3754, and 3755; length 6.25 to 9.2 in.).

Head 3 in length; depth 2.8; eye 3.85 in head; snout 4.5; maxillary 2.1, its distal end under posterior margin of pupil; base of anal fin 2.75 in length.

Scomber lactarius Bloch & Schneider, Syst. Ichth., 31, 1801, **Tranquebar.**
Lactarius delicatulus, Günther, Cat., II, 507.

61. **Caranx boops** Cuvier & Valenciennes. *Atoloy.*

Nine specimens from Bacon (no. 3724, 3807, 4053, 4054, 4084, 4085, 4086, 4102, and 4103; length 7 to 8.25 in.).

Head 3.45 in length; depth 3.1; plates of lateral line 44, the line strongly bent, becoming straight under the posterior third of first dorsal, the plates very large; eye 2.75 in head; adipose eyelid well developed; maxillary 2.1 in head.

In this species the ventrals fall far short of anal spines, the origin of the spines being midway between origin of ventrals and base of ninth anal ray; under jaw strongly projecting.

Caranx boops Cuvier & Valenciennes, Hist. Nat. Poiss., IX, 35 (46), **Amboyna**; Günther, Cat., II, 431; Day, Fishes India, 218, pl. XLIX, fig. 2.

62. **Caranx freeri** Evermann & Seale, new species. *Mataan.*

Head 3.1 in length; depth 3.2; eye 2.85 in head; interorbital 3.55; dorsal VIII—I, 23; anal II—I, 20; lateral line of 25 scales and 47 plates; a broad adipose eyelid.

Body oblong, moderately compressed; depth of caudal peduncle 6.1 in head, its depth less than its width; profile of head from above opercle to snout almost a straight line placed at angle of 35 degrees; mouth large, the lower jaw scarcely projecting; length of maxillary 2.1 in head, its distal end under middle of pupil, the posterior margin concave; mandible 1.75 in head; minute teeth on jaws, vomer, palatines, and tongue, those of jaws in single series; gillrakers long and slim, 24 on lower limb, the longest 5.9 in head; opercle and preopercle entire; body entirely scaled; breast scaled; plates of lateral line very strong, their greatest diameter 4.5 in head; the lateral line with a low curve anteriorly, becoming straight under the posterior dorsal spines, the curved portion 3.2 in straight; scales of the arrow-shaped area in front of dorsal very minute; about 6 rows on cheek; origin of spinous dorsal in vertical line with axil of ventrals, the longest spine 2 in head, longest ray of soft dorsal 2.5; origin of anal under second soft dorsal ray, being midway between base of caudal and posterior margin of orbit, its longest ray 2.55 in head; origin of anterior anal spine midway between origin of ventral and base of seventh anal ray; first anal spine 6.5 in head; ventrals midway between origin of anal and posterior end of maxillary, their length 2 in head, their tips reaching first anal spine; pectoral 1.1 in head, the tip reaching origin of anal; caudal deeply forked, its length 1.1 in head.

Color in spirits, yellowish white, a tint of blue above; tip of snout and tip of under jaw dusky; no distinct opercular spot, but posterior margin of opercles with some slight shading of dusky; dorsals slightly tinted with dusky, most distinct on margin of soft dorsal; scarcely a trace of dusky on tip of caudal; pectorals, ventrals, and anal unmarked.

This species is near *C. boops*, of which we have many specimens. It may be at once separated, however, by the more anterior location of the anal spines, the less projecting under jaw, greater length of head, and greater width of the interorbital space.

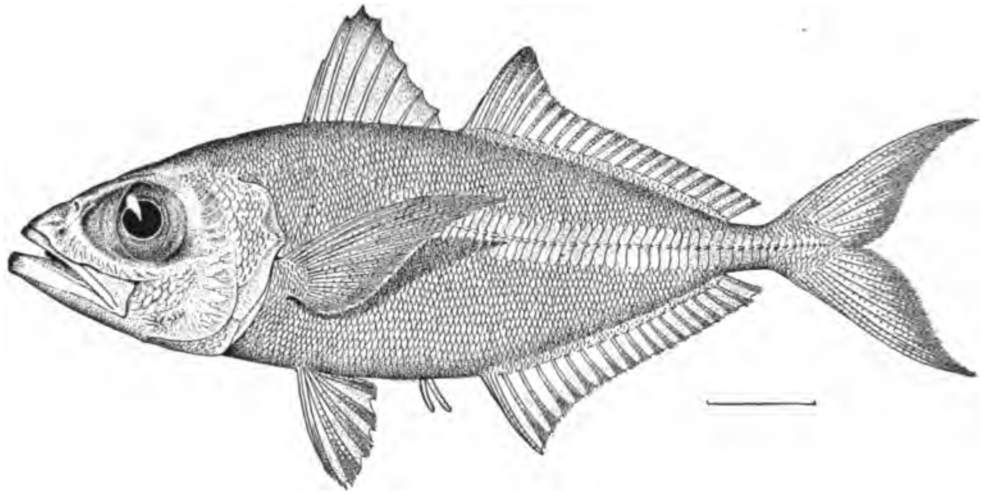

FIG. 4.—*Caranx freeri* Evermann & Seale, new species. Type.

One specimen (no. 3324, type, no., 55913 U. S. National Museum; 9.1 in. long), from San Fabian; collector, Mr. C. L. Hall.

We take pleasure in naming this species for Dr. Paul C. Freer, who, as director of the Philippine Bureau of Science, is doing so much to advance our knowledge of the natural resources of the Philippine Islands.

63. **Caranx cynodon** Bleeker.

One fine specimen from Bacon (?) (no. 4165; length 13 in.).

Head 3.4 in length; depth 2.9; eye 3.85 in head; snout 3.75; pectoral long and falcate, 2.75 in length; maxillary 2 in head, its distal end on line with posterior margin of eye.

Caranx cynodon Bleeker, Nat. Tijds. Ned. Ind., I, 362, 1850, **Batavia**; Günther, Cat., II, 447.

64. **Caranx affinis** Rüppell.

Two specimens from Bulan (no. 3981 and 3837; length 5 and 5.5 in.). Differing from Hawaiian specimens apparently only in the somewhat larger black opercular spot.

Caranx affinis, Rüppell, Neue Wirb., Fische, 49, pl. 14, fig. 1.

65. **Caranx speciosus** (Forskål).

One specimen from Bulan (no. 3638; length 6.5 in.).

Scomber speciosus Forskål, Descr. Anim., 54, 1775, **Red Sea.**
Caranx speciosus, Günther, Cat., II, 444.

66. **Caranx ophthalmotænia** (Bleeker).

Four specimens from Bulan (no. 3907 to 3910; length 3 to 4.5 in.). Dorsal VIII, 27; anal II—I, 23; depth 2; head 3.05; anterior dorsal and anal rays elongate; a brown band from base of mandible upward and backward thru eye to nuchal region; ventrals dusky.

Carangoides ophthalmotænia Bleeker. Nat. Tijds. Ned. Ind., III, 270, 1852, **Amboyna**; Günther, Cat., II, 451.

67. **Caranx sexfasciatus** Quoy & Gaimard. *Talatitogan.*

Nine specimens from San Fabian (no. 3325 to 3333; length 3.5 to 4 in.). Head 3.1 in length; depth 2.5; eye 3 in head; snout 4.2; pectoral 3.3; maxillary 2.1, its distal end scarcely reaching posterior margin of eye; tip of dorsal black. *Carangus rhabdotus* Jenkins, from Honolulu, closely resembles this species, but differs from it in the heavier body, smaller eye, and the broader cross-bands.

Caranx sexfasciatus Quoy & Gaimard, Voy. Uranie, 358, pl. 65, fig. 4, 1824, Papous Islands.

68. **Caranx armatus** (Forskål). *Buensang-sapse; Amaaligan.*

Sixteen specimens from San Fabian (no. 3498, 3446, 4940, and 4941; length 3.2 to 6 in.). No. 4032, length 3 inches, from Bulan, is also placed with this species, although it is slightly deeper and seems to differ in a slight degree.

Sciæna armata Forskål, Descr. Anim., 53, 1775, Red Sea.
Caranx armatus, Günther, Cat., II, 453.

69. **Caranx kalla** Cuvier & Valenciennes.

One specimen from Bulan (no. 3767; length 3 in.). Lateral line becoming straight under about the sixth dorsal ray, which readily distinguishes this species from *C. djeddaba*, to which it is closely related.

Caranx kalla Cuvier & Valenciennes, Hist. Nat. Poiss., IX, 37 (49), 1831, Pondicherry; Day, Fishes India, 219, pl. XLIX, fig. 5.
Caranx calla, Günther, Cat., II, 433.

70. **Caranx djeddaba** (Forskål).

One small specimen from "Philippines" (no. 3782; length 3.5 in.).

Head 3.25 in length; depth 2.75; eye 3.2 in head; snout 4; maxillary 3; mandible 2.1; interorbital 3.75; dorsal VIII, 25; anal I, 22; scutes 54, 37 in curved portion; lateral line becoming straight under the first dorsal ray.

Scomber djeddaba Forskål, Descr. Anim., 1775, Red Sea.
Caranx djeddaba, Günther, Cat., II, 432; Day, Fishes India, 218, pl. XLIX, fig. 3.

71. **Caranx brevis** (Bleeker).

Three specimens from "Philippines" (no. 3888; length 3 to 3.2 in.).

Head 3.5 in length; depth 2.4; eye 3 in head; dorsal VIII, 25; anal II—I, 19; lateral line 34+46.

Teeth in jaws, vomer and palatines; no canines; curved portion of lateral line 1.95 in straight, the line becoming straight under anterior dorsal rays; a distinct opercular spot; breast scaled.

Selar brevis Bleeker, Nat. Tijds. Ned. Ind., I, 1850, 361, Batavia.
Caranx brevis, Günther, Cat., II, 435.

72. **Megalaspis cordyla** (Linnæus). *Bacutut.*

Three fine specimens from Bulan (no. 4155 to 4157; length 14 to 15.5 in.) and 3 from Jolo (no. 4111 to 4113; length 8.5 to 9 in.).

Scomber cordyla Linnæus, Syst. Nat., ed. X, 298, 1758, America.
Scomber rottleri Bloch, Ichth., X, 39, 346, 1797.
Caranx rottleri, Günther, Cat., II, 424.
Megalaspis rottleri, Bleeker, Makreelachtige Visschen, 49, Verh. Bat. Gen., XXIV (Batavia).

73. **Citula halli** Evermann & Seale, new species. *Pampanon.*

Head 3 in length; depth 1.5; eye 3.2 in head; dorsal IV—I, 40; anal II, 38; 76 scales in lateral line, 35 of which are in straight portion, and scarcely armed; snout 3.5; maxillary 3, its distal end on line with anterior margin of eye.

Body elevated, compressed; anterior profile rounded; caudal peduncle narrow, 5.5 in head; body, including breast, covered with deciduous scales, which are of small size on thorax; lateral line almost straight, the curve being very long and low, the greatest depth of curve 7 in its length, the straight portion of line 2.5 in curved part.

Depth of head much greater than its length; jaws equal; teeth very fine, sharp, in a single series in each jaw; no teeth on vomer, palatines or tongue; opercle and preopercle entire; gillrakers sharp, 13 on lower limb, the longest equal to one-half diameter of eye.

Spinous dorsal of 4 minute spines, connected only at base; anterior rays of soft dorsal and anal greatly elongate, the longest dorsal ray 2 in length; longest anal ray 2.25; caudal deeply forked, 3.5; pectoral 3.5; ventrals 4, their tips extending to base of anal; vertical fins without scaly sheath.

Color in spirits, yellowish, with 5 vertical brown bands of greater width than interspaces, the anterior one forming a distinct ocular band from spinous dorsal through eye to ventrals, the second from anterior of soft dorsal to belly, the third from fifth to fourteenth dorsal rays to anterior of anal; fourth from posterior third of dorsal to middle of anal; the fifth near posterior of dorsal and anal; two oblique bands on each caudal lobe; anterior half of dorsal and anal black; ventrals black; pectoral yellowish; opercles dusky; belly with bluish wash.

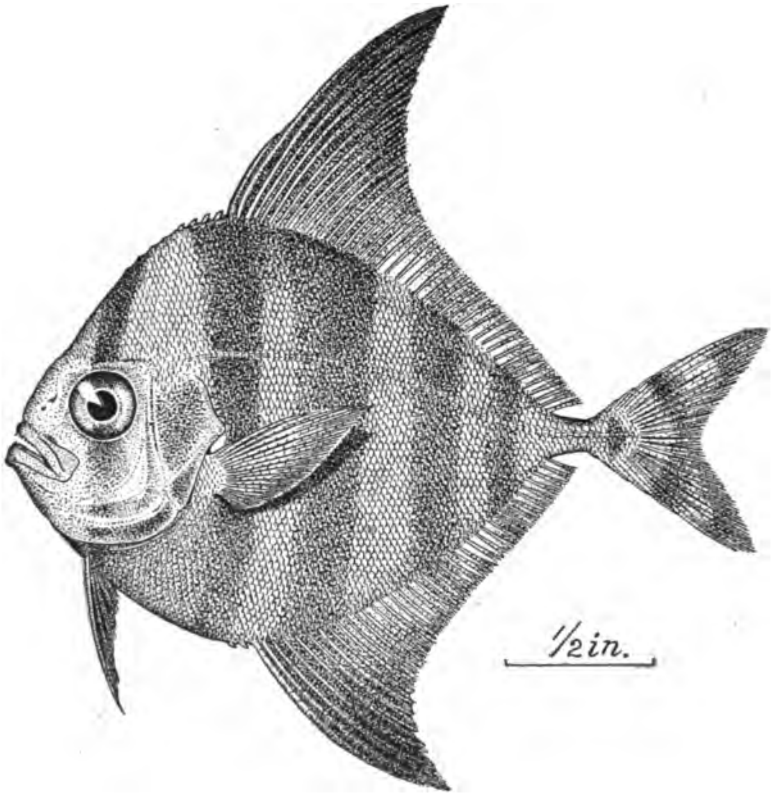

FIG. 5.—*Citula halli* Evermann & Seale, new species. Type.

One specimen, the type, no. 55914 U. S. National Museum (original no. 4029), 2.5 inches long, from San Fabian.

Easily distinguished from *Alectis ciliaris*, to which it bears a superficial resemblance, by the low curve of the lateral line. Named for Mr. C. L. Hall, who collected at San Fabian many of the specimens on which this report is based.

74. **Trachinotus baillonii** (Lacépède). *Bitilla.*

One specimen from Zamboanga (no. 3761; length 8.75 in.).

Head 3.8 in length; depth 2.3; eye 3.1 in head; snout 4.1; dorsal, anal and caudal lobes much produced, all blackish; 4 small round black spots on lateral line on middle of side.

Cæsiomorus baillonii Lacépède, Hist. Nat. Poiss., III, 93, pl. 3, fig. 1, Indian Ocean.
Trachynotus baillonii, Günther, Cat., II, 484.

Family EQUULIDÆ.

75. **Leiognathus virgatus** Fowler.

Two specimens from Bulan (no. 3916; length 2.5 and 2.75 in.).

Leiognathus virgatus Fowler, Journ. Ac. Nat. Sci. Phila., 2d ser., XII, 1904 (June 10), 515, pl. XV, fig. 4, Pedang, Sumatra.

76. **Leiognathus dussumieri** (Cuvier & Valenciennes). *Malaway.*

Two specimens from San Fabian (no. 3210 and 3212; length 6 and 6.2 in.).

Head 3.2 in length; depth 1.9; eye 3.1 in head; snout 3.1; spine-shaped crest on nuchal region not reaching halfway to base of first dorsal spine.

Equula dussumieri Cuvier & Valenciennes, Hist. Nat. Poiss., X, 56 (77), pl. 283, 1835, Coromandel; Günther, Cat., II, 500.

77. **Leiognathus splendens** (Cuvier). *Masangui.*

Two specimens from San Fabian (no. 3955 and 3959; length 2.5 and 3.75 in.), one from "Philippines" (no local label, No. 3765; length 2.75 in.), and 3 from Bacon (no. 4030; length 2.5 to 2.75 in.).

Breast scaled; supraorbital serrate; lateral line not so strongly arched as in *L. edentulus*, the anterior part slightly concave; tip of dorsal black.

Equula splendens Cuvier, Règne Anim., II, 212, 1829, Indies; Günther, Cat., II, 501.

78. **Leiognathus stercorarius** Evermann & Seale, new species.

Head 3.7 in length; depth 3; eye 3 in head; snout 3; interorbital 3; dorsal VIII, 17; anal III, 14; scales 57.

Body oblong, moderately compressed, the upper and lower profiles almost evenly curved; jaws equal; depth of caudal peduncle 4.9 in head; entire body covered with thin deciduous scales; cheek and breast scaled; lateral line complete, with a long low curve from caudal peduncle to head; mouth very protractile; the groove for the processes of the maxillary extending to a line with posterior margin of eye, the length of the bony spine-shaped crest extending back from the groove 2.6 in head; upper jaw heavy; minute teeth in jaws, none on vomer, palatines or tongue; no canines; twelve gillrakers on lower limb, the longest about 2 in pupil; maxillary ending on a line with anterior margin of eye, scarcely one-half exposed; mandible 2 in head, at angle of 30°; width of preorbital 1.85 in snout; lower limb of preopercle denticulate on its inferior border; opercle entire; eye with slight adipose eyelid.

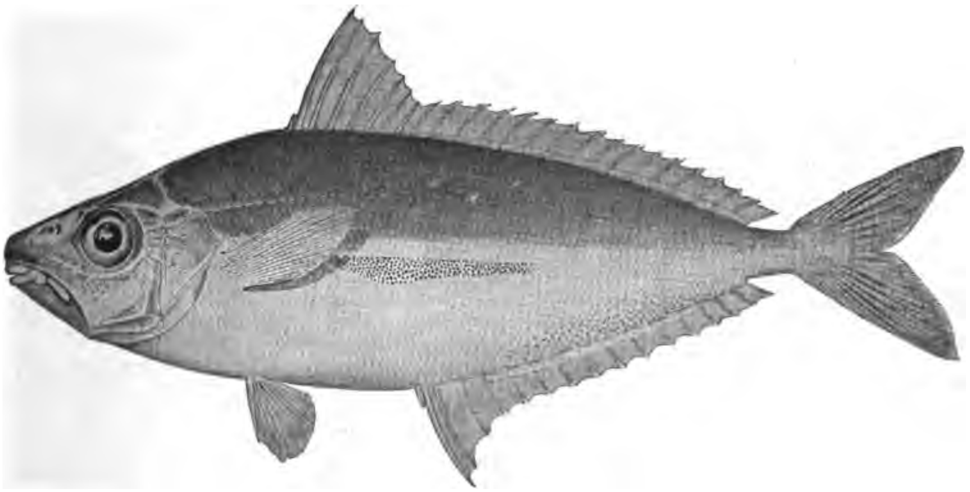

FIG. 6.—*Leiognathus stercorarius* Evermann & Seale, new species. Type.

Origin of dorsal slightly posterior to origin of ventrals, longest dorsal spine 1.75 in head, about one-half depth of body (in another specimen—a cotype—this spine measures 1.4 in head and is greater than one-half depth of body), the first dorsal spine minute, the second longest, the dorsal continuous, none of the spines or rays elongate; anal similar to dorsal but shorter; the first anal spine midway between tip of snout and base of caudal; the longest spine 2 in head, none of the anal spines or rays elongate; vertical fins without scales but with deep sheaths; pectoral 1.7 in head; ventrals 2.25 in head, their origin midway between origin of anal and posterior end of mandible; caudal deeply forked.

Color in spirits, light brown above, silvery below, with a slight wash of yellowish; a peculiar lanceolate area on middle of side shaded with fine black dots, and having the appearance of an abrasion; fine brownish dots just above anal fin; upper half of body with numerous vermiculate brownish lines; a black line on base of dorsal; upper lip dusky; dusky dots in axil of pectoral; anterior spines of dorsal and anal with some fine brown dots, most distinct on anal, otherwise fins unmarked.

This species is related to *L. oblongus* but differs among other things in having scales on chest. It is more elongate than *L. rivulatus* and *L. lineatus*, with which we have compared it.

Seven specimens from Bulan, length 3.75 to 4 in. Type, no. 55906, U. S. National Museum (field no. 3591), length 4.75 in., from Bulan, Sorsogon, P. I. Of the cotypes, all from Bulan, one (field no. 3590) is no. 20004 Stanford Univ. Mus.; another (field no. 3588) is no. 4537 U. S. Bureau of Fisheries; another (field no. 3587) is in the museum at Manila; another (field no. 3589) is in the U. S. National Museum; another (field no. 3592) is in Philadelphia Academy of Natural Sciences; another (field no. 3593) is in the Indiana University Museum. (*Stercorarius* of or pertaining to dung; from the fly-spects on the side.)

79. **Leiognathus edwardsi** Evermann & Seale, new species. *Patuan.*

Head 3.6 in length; depth 2.6; eye 2.75 in head; snout 2.9; interorbital 3.1; dorsal VIII, 16; anal III, 13; scales about 70, about 48 pores.

Body oblong-ovate, the dorsal and ventral outlines about equally curved and gently arched; head moderate, pointed, snout pointed; mouth small, very protractile, the lower jaw included; maxillary short, its exposed tip pointed, scarcely reaching vertical of orbit; teeth in jaws fine, villiform; vomer and palatines apparently toothless; eye large, in middle of head; lower edge of preopercle entire; cheek deep, greater than interorbital width; a broad, blunt supraocular spine over anterior part of eye; interocular space broadest anteriorly, its length nearly twice its greatest width; occipital ridge greater than diameter of orbit and slightly greater than distance from its tip to origin of dorsal fin; origin of dorsal fin posterior to insertion of ventrals; first dorsal spine produced and filamentous (the tip broken off), its length probably about 1.5 in length of body; soft dorsal low; origin of anal under about sixth dorsal spine; first spine greatly produced and filamentous, its length about 1.8 in depth; anal rays short; both dorsal and anal fins folding into a

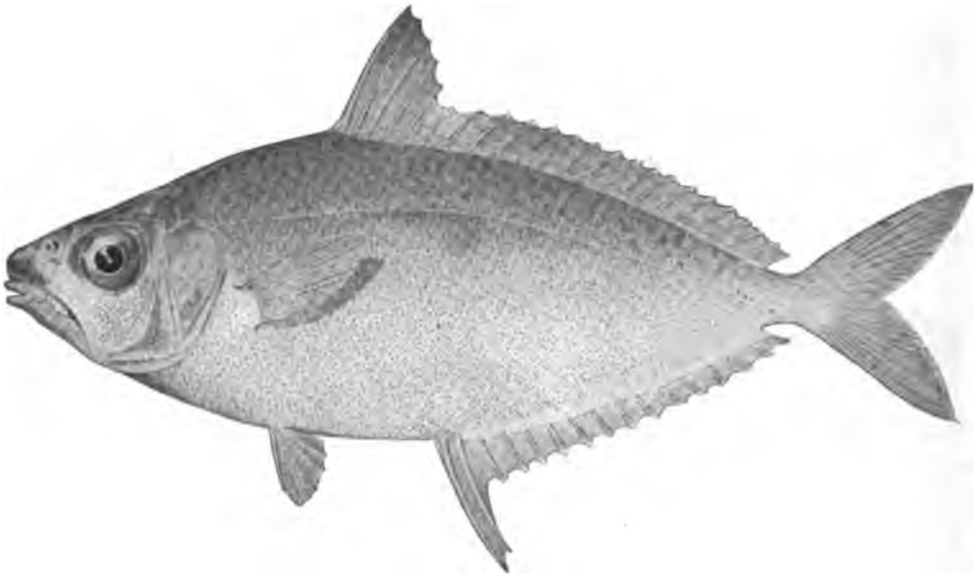

FIG. 7.—*Leiognathus edwardsi* Evermann & Seale, new species. Type.

shallow groove; pectoral short, its length about 1.5 in head; ventrals short, their length slightly greater than diameter of orbit, the distance from their tips to base of first anal spine 1.5 in their length; caudal broadly forked, the lobes about 1.25 in head; scales small, thin, and deciduous; lateral line in a low regular arch from upper edge of gill-opening to base of caudal; breast naked.

Color in spirits, dirty olivaceous yellow, back more or less marbled and vermiculated with brownish; a dark line along base of dorsal fin; cheek and lower half of side finely punctulate with dark dots; tip of snout black; axil of pectoral dusky; fins otherwise pure yellowish.

This species is based on a single specimen 5 inches long, field no. 3876 (10778), from San Fabian, Pangasinan. Type, no. 55904, U. S. National Museum. It is apparently related to Günther's *Equula leuciscus*, from which it differs, however, in the smooth preopercle, the presence of a supraocular spine, and the less development of the anterior dorsal spine. We take pleasure in naming this species for Brig. Gen. Clarence R. Edwards, U. S. Army, Chief of the Bureau of Insular Affairs, U. S. War Department.

80. **Leiognathus fasciatus** (Lacépède).

Four specimens from San Fabian (no. 3211 and 3956 to 3958; length 3.25 to 6.2 in.).

Body very deep, back strongly arched. Head 3.18 in length; depth 2; eye 3 in head; snout 2.95; two strong supraocular spines; lower limb of preopercle serrate; scales very small, breast naked; lateral line complete, 60; body with about 18 narrow black vertical bars.

Clupea fasciata Lacépède, Hist. Nat. Poiss., v, 460, 1803.
Equula fasciata, Günther, Cat., ii, 498, 1859.

81. **Leiognathus edentula** (Bloch).

Four specimens from San Fabian (no. 3950 to 3953; length 2.75 to 3.5 in.).

Body very deep, the back much arched; breast naked; lateral line strongly arched, the anterior part at first slightly concave.

Head 3 in length; depth 1.7; eye 3 in head; snout 2.75; nuchal crest almost reaching base of first dorsal spine, which is 2.5 in depth; teeth not evident; tip of dorsal fin not black.

Scomber edentulus Bloch, Ichth., pl. ccccxxviii, 1785.
Equula edentula, Günther, Cat., ii, 498; Day, Fishes India, 238, pl. lii, fig. 1.

82. **Gazza tapeinosoma** Bleeker.

Five specimens from the Philippines (no local label given; no. 3779, 3780, 3781, 3783, and 3784; length 3.75 to 5.2 in.), and 8 from Bulan (no. 3489 to 3496; length 4.5 to 5 in.).

Gazza tapeinosoma Bleeker, Nat. Tijds. Ned. Ind., iv, 260, 1853, Batavia.
Gazza argentaria, Günther, Cat., ii, 506; probably not of Forster.

83. **Gazza minuta** (Bloch). *Matambo; Bugsang.*

Seven specimens from San Fabian (no. 3947 to 3949 and 3868 to 3871; length 2.75 to 4 in.).

Head 2.9 in length; depth 2; eye 2.75 in head; snout 3.1; scales minute, lateral line complete; breast naked; preopercle serrate.

Scomber minutus Bloch, Ichth., xii, 110, pl. ccccxxix, fig. 2, 1797, no locality given
Gazza minuta, Günther, Cat., ii, 506.

Family GERRIDÆ.

84. **Xystæma punctatum** (Cuvier & Valenciennes).

Three specimens from Bulan (no. 3220 to 3223; length 4.75 to 5.2 in.), agreeing well with the figures given by Bleeker and by Day and with Day's description.

Gerres punctatus Cuvier & Valenciennes, Hist. Nat. Poiss., vi, 361 (480) 1830, Pondicherry.
Gerres filamentosus, Günther, Cat., i, 345, and iv, 261; Day, Fishes India, 98, pl. xxv, fig. 3.

85. **Xystæma baconensis** Evermann & Seale, new species. *Duldul.*

Head 3.25 in length; depth 2.6; eye 3.25 in head; snout 3; lateral line complete; scales about 4-47-8; interorbital 2.8 in head; maxillary 2.5; depth of cheek 3.3; dorsal ix, 10; anal iii, 7; pectoral 1.1 in head; ventrals 1.9.

Body moderately elongate, the back rather strongly arched, the profile rising in a regular curve from tip of snout to origin of dorsal fin, thence descending in a broader curve to caudal peduncle; ventral outline less convex; head pointed, the lips thick, jaws subequal, or the lower slightly the shorter; premaxillary strongly protractile; exposed portion of maxillary broad, its greatest width half its length, its posterior edge slightly concave; preopercle entire; interorbital broad; premaxillary groove narrow, completely scaled except a small circular area posteriorly above anterior margin of orbit; caudal peduncle rather deep, its greatest depth greater than diameter of eye, or 3 times its least width. Scales large, thin, and firm; origin of dorsal fin over base of pectoral, the second spine slender, curved, and lengthened, its length greater than half that of head; dorsal rays short; second anal spine shorter and scarcely larger than the third, its length 1.4 in eye; dorsal and anal fins each with a high, scaly sheath; caudal fin thickly covered with fine scales; peritoneum dusky; second interhæmal spine long and slender; posterior end of air-bladder bifid, ending in 2 long slender horns which fit alongside of second interhæmal.

Color in spirits, silvery white, the back and upper part of side showing faint dark lines along the middle of each row of scales parallel with the back; tip of spinous dorsal dark, fins otherwise unmarked. This species is close to *X. kapas*, from which it differs chiefly in having the premaxillary groove scaled, the eye larger, the interorbital space broader, and the second anal spine smaller.

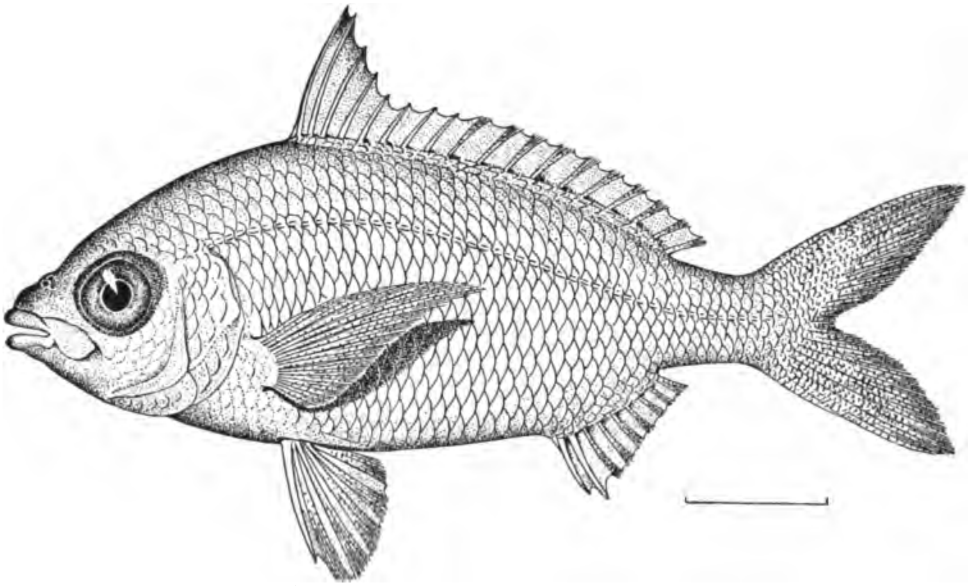

FIG. 8.—*Xystæma baconensis* Evermann & Seale, new species. Type.

This species is represented in our collection by two specimens—one (no. 3416) from Bacon, and the other (no. 3377) from Jolo. Type, no. 55912, U. S. National Museum, a specimen 7 inches long, from Bacon, Sorsogon, P. I. The other, a specimen 5.5 inches long is a cotype, no. 4538, U. S. Bureau of Fisheries.

86. **Xystæma kapas** (Bleeker). *Duldul.*

We refer to this species one specimen (no. 3376) 5.35 in. long from Jolo, 9 specimens (no. 3417, 3418, 3637 to 3639, and 3822 to 3825, 3.2 to 6.5 in. long) from Bacon, and 2 small examples (no. 3890) from Bulan.

Head 3.2 in length; depth 2.7; eye 3.5 in head; snout 3.2; interorbital 2.9; scales 4–40–9; maxillary groove naked, interorbital width greater than orbit; preopercle not denticulate; base of ventrals midway between tip of snout and origin of anal; longest dorsal spine about 2 in depth of body; second anal spine somewhat stronger but shorter than the third, its length 3.3 in head or 4.25 in depth.

Color in spirits, silvery, tip of spinous dorsal black; body without longitudinal darker lines.

Our specimens agree perfectly with Bleeker's figure of this species, but differ from Günther's description in the shorter second anal spine. They seem to differ from *X. oyena* (Rüppell) in the lower curve of the dorsal outline and the absence of dark lateral lines along the rows of scales.

Gerres kapas Bleeker, Nat. Tijds. Ned. Ind., II, 1851, 482, **Batavia.**
Diapterus kapas Bleeker, Atlas, VIII, 127, pl. CCCLXI, fig. 3 (East Indies).
Gerres kapas, Günther, Cat., IV, 259.

Family MÆNIDÆ.

87. **Emmelichthys leucogrammicus** Bleeker.

Nine specimens from Bulan (no. 3971; length 2.5 to 3.2 in.), and one from Bacon (no. 3758; length 1.85 in.). These agree well with Bleeker's figure.

Emmelichthys leucogrammicus Bleeker, Nat. Tijds. Ned. Ind., I, 103, 1850, **Celebes**; Atlas, VII, pl. CCXCIV, fig. 2.
Erythrichthys leucogrammicus, Günther, Cat., I, 396.
Dipterygonotus leucogrammicus Bleeker, Atlas, VIII, 42.

Family SCORPIDIDÆ.

88. **Monodactylus argenteus** (Linnæus).

One specimen from Bulan (no. 3594; length 3.75 in.). Head 2.9 in length; depth 1.2; eye 2.6 in head; snout 5.2. Color in spirits dusky silvery, a black band from nape through eye to lower edge of gill-opening and another across body and base of pectoral just posterior to gill-opening to origin of dorsal and anal and then extending on those fins to tips of produced rays.

Chætodon argenteus Linnæus, Amoen. Acad., IV, 249, 1759.
Psettus argenteus, Günther, Cat., II, 487.

Family APOGONICHTHYIDÆ.

89. **Amia frænata** (Valenciennes).

One specimen from Bacon (no. 3766; length 3.75 in.). (Not *A. frenatus* of Günther.)

Head 2.5 in length; depth 3.18; snout 4; eye very large, longer than snout, 3.1 in head; side with a well-defined black band about width of pupil, extending through eye and across tip of snout, where it is most distinct; a distinct black spot on caudal peduncle at base of caudal fin; a black bar on base of anal; anterior dorsal spines black.

From *Amia snyderi* this species seems to differ in the larger eye, more slender body, and better defined black caudal spot and lateral band. The two may, however, be identical.

Apogon frænatus Valenciennes, Nouv. Ann. Mus. Hist. Nat., 57, pl. 4, fig. 4, 1832.

90. **Amia koilomatodon** (Bleeker).

Two fine specimens from Bacon (no. 3509 and 3511; length 4.75 and 5.2 in.). These agree in every respect with specimens from Samoa.

Apogon koilomatodon Bleeker, Nat. Tijds. Ned. Ind., IV, 134, 1853, **Ternate.**
Amia koilomatodon Bleeker, Atlas, VII, pl. CCCVII, fig. 1; Jordan & Seale, Bull. U. S. Bu. Fish., XXV, 1905 (1906), 240, fig. 34.

91. **Amia quadrifasciata** (Cuvier & Valenciennes). *Bakutut.*

Twenty-nine specimens from Jolo (no. 3555 to 3583; length 2.5 to 3.5 in.), all showing the indistinct vertical bands, in addition to the 2 distinct longitudinal stripes; no caudal spot, the lower longitudinal stripe extending to tip of caudal.

Apogon quadrifasciatus Cuvier & Valenciennes, Hist. Nat. Poiss., II, 113 (153), 1828, **Pondicherry**; Günther, Cat., I, 239; Day, Fishes India, 59.
Amia quadrifasciata, Bleeker Atlas, VIII, 88, pl. CCCXXXV, fig. 1.

92. **Amia fasciata** (Quoy & Gaimard).

Four specimens from Bacon (no. 5752; length 1.25 to 1.5 in.), similar in every respect to a specimen from Samoa. The upper and lower bands converge on the caudal fin, touching or nearly so, the median band near tip of tail.

The type of *Apogon fasciatus* Quoy & Gaimard, came from Guam and the same specimen appears to have been used by Cuvier & Valenciennes as one of the types of their *Apogon novemfasciatus* published five years later. The other specimen in the possession of Cuvier & Valenciennes came from Timor and, according to a recent note from Mr. Vaillant, appears to be the same species.

Apogon fasciatus Quoy & Gaimard, Voy. Uranie, Zool., 344, 1824, **Guam** (type in Paris Mus.).
Apogon novemfasciatus Cuvier & Valenciennes, Hist. Nat. Poiss., ii, 114 (154), 1829, in part; **Guam specimen.**
Apogon fasciatus, Day, Fishes India, 60, in part; not of White.

93. **Amia chrysopoma** (Bleeker).

Two specimens from Bacon (no. 3976 and 3365; length 3.1 and 4 in.).

Head 2.85 in length; depth 2.85; eye 2.75 in head; dorsal vii–i, 9; anal ii, 8; scales 2–29–6; posterior limb of preopercle serrate, anterior limb entire; maxillary extending to below middle of eye; gillrakers 20 on lower limb.

These specimens agree with Bleeker's description, except that the color in spirits is slightly different. They are yellowish with 2 very indistinct dusky longitudinal lines, the lower one being on the median line, and easily overlooked; a black caudal spot just above lateral line, 5 pearl-colored spots on opercle; anterior of spinous dorsal dusky; other fins immaculate.

Apogon chrysopomus Bleeker, Nat. Tijds. Ned. Ind., vii, 1854, 239, **Macassar.**
Amia chrysopomus Bleeker, Atlas, vii, 86, and Atlas, viii, pl. cccxlix, fig. 1.
Apogon chrysopomus, Günther Cat., i, 240.

94. **Amia hartzfeldi** Bleeker.

Nine specimens from Bacon (no. 2899, 4194, 4195, 4196 and 3810 to 3814; length 3.2 to 4 in.).

These seem in every respect similar to specimens from Cavite, and agree entirely with Bleeker's colored plate of this species.

Amia hartzfeldi Bleeker Nat. Tijds. Ned. Ind., iii, 254, 1852, **Amboyna.**
Apogon hartzfeldii, Günther, Cat., i, 242.

95. **Amia savayensis** (Günther).

Six specimens from Bacon (no. 3510, 3880 to 3883 and 3885; length 2.75 to 3.75 in.), all having the dark saddle over caudal peduncle, dark upper and lower margin to caudal, and a more or less distinct dusky line from eye to angle of preopercle; anterior spines of spinous dorsal dusky; anterior rays and tip of soft dorsal dusky; only two specimens show traces of vertical bands seen on some Samoan specimens.

Apogon savayensis Günther, Proc. Zool. Soc. Lond. 1871, 656, **Savaii, Samoa**; Fische der Südsee, 21, pl. 19, fig. b (Samoa; Tonga; Yap; Tahiti).

96. **Amia sangiensis** (Bleeker).

One specimen from Bulan (no. 3889; length 3 in.). The dorsal formula is vii–i, 9, instead of vi-i, 8 or 9, as given, the first spine being very minute and easily overlooked.

Apogon sangiensis Bleeker, Nat. Tijds. Ned. Ind., xiii, 1857, 375, **Sangi**; Günther, Cat., i, 235 (Sea of Sangi).
Amia sangiensis Bleeker Atlas, vii, 95, pl. cccxix, fig. 4.

97. **Amia monochrous** (Bleeker).

Two specimens in poor condition from Bulan (no. 4015 and 4016; length 3.5 and 3.75 in.).

Apogon monochrous Bleeker, Manado en Macassar, 34, Act. Soc. Sci. Ind. Ned., 1856, **Manado**; Günther, Cat., i, 236.

98. **Amia novæ-guineæ** (Valenciennes).

Five specimens from Bulan (no. 4007 and 4013; length 2.1 to 2.56).

Apogon novæ-guineæ Valenciennes, Nouv. Ann. Mus. Hist. Nat., 53, pl. 4, 1832, **New Guinea**; Günther, Cat., i, 237.

99. **Amia jenkinsi** Evermann & Seale, new species.

Head 2.75 in length; depth 2.9; eye 3 in head; snout 4.6; interorbital 4.2; dorsal vii–i, 9; anal ii, 8; scales 3–25–5.

Body oblong, moderately compressed; depth of caudal peduncle 2.4 in head; anterior profile from base of dorsal to tip of snout forming a straight line at an angle of about 15°; mouth large; lower jaw the longer; maxillary 2.1 in head, its posterior margin under middle of pupil, the width of distal end equal to pupil; mandible 1.75 in head; minute teeth on jaws, vomer, and palatines in 1 or 2 rows; 16 gillrakers on lower limb, the longest about 7 in head; posterior limb of preopercle finely denticulate, a few scattered denticulations at angle of anterior limb; opercle with an indistinct spine on posterior margin; body entirely covered with large weakly ctenoid scales; lateral line complete; 2 rows of scales on cheek; origin of spinous dorsal midway between tip of snout and posterior axil of soft dorsal, the longest spine 2.1 in head; longest ray of soft dorsal 1.75 in head; origin of anal under middle of soft dorsal, its base 2.25 in head, longest ray 2 in head; origin of ventrals under base of pectoral, their length 1.75 in head; pectoral 1.5 in head; caudal rounded, 1.5 in head.

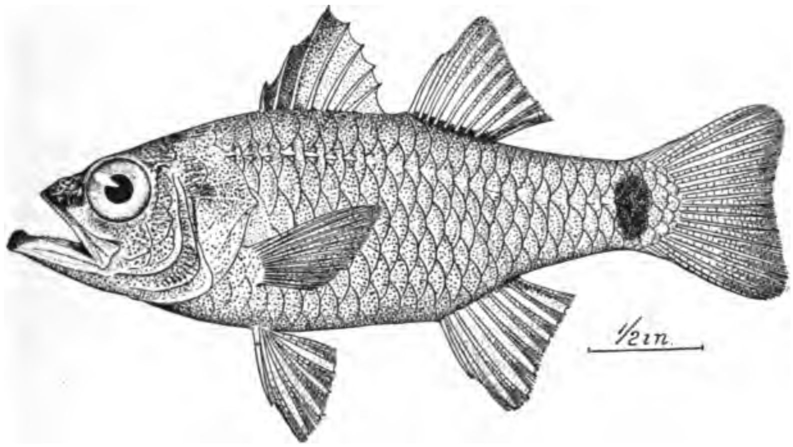

FIG. 9.—*Amia jenkinsi* Evermann & Seale, new species. Type.

Color in spirits, dull yellowish, shaded with minute brown punctulations, a large quadrate black spot on middle of base of caudal; a round jet-black spot about size of pupil on each side of nuchal region; a wide distinct black line on side of snout from eye to mouth; tip of lower jaw black; spinous dorsal black; a shading of dusky on base of soft dorsal and anal, otherwise fins all yellowish. One specimen, the type, no. 55907, U. S. National Museum (field no. 4036), length 3.4 in., from Bulan, Sorsogon, P. I.

Named for Dr. O. P. Jenkins, of Stanford University.

100. **Amia endekatænia** (Bleeker).

Three specimens from Bacon (no. 3839 and 3818; length 2.25 to 3.5 in.).

A. endekatænia is undoubtedly a species distinct from *A. fasciata*, easily distinguished by the bluntly rounded profile of the head, the short snout, and the more rounded preopercle. Gillrakers 11 on lower limb (including nodules); only posterior limb of preopercle serrated. Our specimens are faded, but the 4 dusky longitudinal lines are quite perceptible in the large specimen; also the rather diffused dusky caudal spot. The small specimens have the spinous dorsal tipped with dusky and show indistinct traces of dusky vertical lines, as in *A. quadrifasciata;* the large specimen has ventrals tipped with dusky.

Apogon endekatænia Bleeker, Nat. Tijds. Ned. Ind., III, 1852, 449, **Banka.**
Amia endekatænia Bleeker Atlas, VII, 85, pl. CCCX, fig. 2.

101. **Amia margaritophora** (Bleeker).

One specimen from Bacon (no. 4197; length 1.75 in.).

Head 2.75 in length; depth 2.9; eye 3 in head; dorsal VI–I, 9; anal II, 8; scales 3–25–7; teeth on palatines and vomer.

Apogon margaritophorus Bleeker, Nat. Tijds. Ned. Ind., VII, 1854, 363, **Batjan.**
Amia margaritophorus Bleeker, Atlas, VII, 91, pl. CCCI, fig. 4; Günther, Cat., I, 234.

102. **Apogonichthys mentalis** Evermann & Seale, new species.

Head 2.75 in length; depth 3.4; eye 3.1 in head; snout 4; interorbital equal to snout; dorsal VI–I, 10; anal II, 12 (the small anterior anal spine broken off in type); scales probably about 28, deciduous.

Body oblong, moderately compressed; depth of caudal peduncle 3.2 in head; mouth large, the lower jaw the longer; maxillary 2.5 in head, its distal end under anterior margin of pupil; mandible 2.15 in head; minute teeth in jaws, none on vomer or palatines; 20 gillrakers on lower limb, the longest equal to pupil; no denticulations on preopercle; opercle with a single point; entire body covered with thin, very deciduous cycloid scales; lateral line probably complete, apparently a single row of scales on cheek; origin of spinous dorsal midway between tip of snout and axil of soft dorsal; longest dorsal spine 2.5 in head; base of soft dorsal 1.75 in head, its longest ray 2 in head; origin of anal under anterior third of soft dorsal, its longest ray 2.75 in head, its base 1.75; ventrals below base of pectoral, their length 2.1 in head; pectoral 1.3, the tip reaching beyond anal spines; caudal rounded.

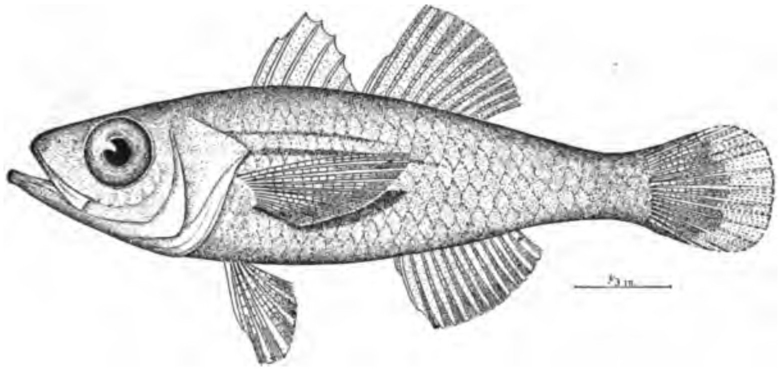

FIG. 10.—*Apogonichthys mentalis* Evermann & Seale, new species. Type.

Color in spirits, yellowish white; 2 black longitudinal lines separated by pale yellow on side to below posterior end of soft dorsal; some dark dots on opercle, a shading of dusky at tip of snout and on tip of lower jaw; fins all uniform yellowish white.

Two specimens, the type, no. 55905, U.S. National Museum (B. F. no. 3772, field no. 10696), a female full of mature eggs, and cotype no. 20002, Stanford University, each about 2.5 inches long, from Bacon, Sorsogon, P. I.; collector Charles J. Pierson.

103. **Archamia macropteroides** (Bleeker).

Thirty-eight specimens from Bacon (no. 3896, 3867, 3991, and 3884; length about 3 in.).

Head 2.75 in length; depth 2.45; eye 3 in head; snout 5.5; dorsal VI–I, 10; anal II, 17; scales 4–27–9.

Color in spirits, dirty yellowish, the body and head thickly punctulate with blackish; a large black spot at base of caudal and a similar but smaller one on shoulder, these both very distinct.

Our specimens differ from those from Samoa, which Jordan & Seale identified with *A. lineolata* (Ehrenberg) in having the body deeper, the eye larger, the head blunter, and the shoulder spot always distinct. *A. bleekeri* differs from the present species in the shape of the caudal spot and the more anterior position of the shoulder spot.

Apogon macropteroides Bleeker, Nat. Tijds. Ned. Ind., III, 1852, 724, **Lepar Island, Banka**; Günther, Cat., I, 245.

104. **Archamia bleekeri** (Günther). *Masangui.*

Forty-eight specimens from Bacon (no. 3279 to 3306 and 3678; length 1.5 to 3 in.), and 2 from San Fabian (no. 3815; length 1.25 in.).

These each have 16 anal rays, a round black spot at base of caudal, its outline sharply defined, a large black spot at anterior end of lateral line, touching upper edge of opercle, and a dusky line from eye to subopercle. Resembling *A. macropteroides* but readily distinguished by the form and position of the caudal and humeral spots.

Among our specimens are both males and females. Nearly mature eggs were found in the ovaries of some of the females, and a mass of mature eggs was discovered in the mouth of a male. It has long been asserted that the male of certain species of this family carries the eggs in his mouth during incubation. Measurements of 10 of these eggs gave an average diameter of 0.51 mm.

Apogon bleekeri Günther, Cat., I, 245, 1859, Batavia; Padang; Amboyna.
Apogon macropterus, Bleeker, Nat. Tijds. Ned. Ind., ii, 168, 1851, and Atlas, viii, pl. cccxlvi, fig. 2.

Family AMBASSIDÆ.

105. **Ambassis urotænia** Bleeker.

One hundred and three specimens from Bacon (no. 3408 and 3621; length 1.75 to 3 in.).

Head 2.75 in length; depth 2.75; eye 3.1 in head; snout 4.75; second dorsal spine 4 in length; dorsal vii–i, 9; anal iii, 10; scales 4–28–6, 2 rows on cheek.

Ambassis urotænia Bleeker, Nat. Tijds. Ned. Ind., iii, 1852, 257, Amboyna; Atlas, viii, 135, pl. cccxliv, fig. 2, and pl. cccli, fig. 1; Günther, Cat., i, 224.

106. **Ambassis lungi** (Jordan & Seale).

Four specimens from Bacon (no. 3834 and 4192; length 1 to 3 in.).

This species is easily distinguished by the single row of scales on cheek, the broken lateral line, and the color of the fins and back.

Ambassis urotænia, Day, Fishes India, pl. xv, fig. 8; not of Bleeker.
Priopis lungi Jordan & Seale, Bull. Bu. Fisheries, xxvi, 1906, 18, fig. 6, Cavite, Luzon.

Family PEMPHERIDÆ.

107. **Pempheris vanicolensis** Cuvier & Valenciennes.

Eight specimens from Bacon (no. 3213 to 3218, 3542 and 3762; length 3.75 to 6 in.), and 3 young from Bulan (no. 3817).

Head 3.4 in length; depth 2.2; eye 2.6 in head; snout 6.5; anal iii, 43.

No black spot on base of pectoral; anterior dorsal rays black-tipped; edge of anal black. These characters distinguish the species.

Pempheris vanicolensis Cuvier & Valenciennes, Hist. Nat. Poiss., vii, 227 (305), 1831, Vanicolo.

Family SERRANIDÆ.

108. **Epinephelus merra** Bloch.

Four specimens from Bacon (no. 3630, 3631, 3632, and 4082; length 4 to 6.5 in.).

Epinephelus merra Bloch, Ichth., vii, 17, pl. cccxxi, 1797; Boulenger, Cat., i, 241, 1895.

109. **Epinephelus tauvina** (Forskål).

One specimen from Bacon (no. 3633; length 1.4 in.).

Perca tauvina Forskål, Descr. Anim., 39, 1775, Red Sea.
Epinephelus tauvina, Boulenger, Cat., i, 244.

110. **Epinephelus fasciatus** (Forskål).

One fine specimen from Bacon (no. 4040; length 10.75 in.).

Perca fasciata Forskål, Descr. Anim., 40, 1775, Red Sea.
Epinephelus fasciatus, Boulenger, Cat., i, 238.

111. **Epinephelus maculatus** (Bloch).

Two fine specimens from San Fabian (no. 3224 and 3225; length 4.5 and 8.5 in.).

Holocentrus maculatus Bloch, Ichth., IV, 96, pl. CCXLII, fig. 3, 1797.
Epinephelus maculatus, Boulenger, Cat., I, 211.

112. **Cephalopholis pachycentron** (Cuvier & Valenciennes).

Three specimens from Bacon (no. 3385, 3386, and 3850; length 5.5 to 5.75 in.).

Dorsal IX, 15; anal III, 8; scales 80. The specimens are without light margin to fins and the ventrals extend to vent; otherwise they agree with the descriptions.

Serranus pachycentron Cuvier & Valenciennes, Hist. Nat. Poiss., II, 219 (295), 1828 (type no. 7432, Paris Museum).
Epinephelus pachycentrum, Boulenger, Cat., I, 178.

113. **Cephalopholis kendalli** Evermann & Seale, new species.

Head 2.66 in length; depth 2.85; eye 6.3 in head; snout 4.75; interorbital 7.5; maxillary 2.1, its distal end reaching beyond orbit, the distal width of maxillary 1.1 in orbit; dorsal IX, 16; anal III, 8; scales about 20-80-22, 45 pores.

Body oblong, moderately compressed; depth of caudal peduncle 3 in head; anterior profile evenly curved from origin of dorsal to snout, slightly concave before and behind eye; mouth large, lower jaw slightly projecting; several bands of sharp teeth in each jaw with a single curved canine on each side anteriorly, the inner teeth largest and depressible; teeth on vomer and palatines; gillrakers sharp, their inner surface spinulose, 9 developed on lower limb, the longest 2 in orbit; margin of preopercle rounded, finely denticulate, the denticulations scarcely enlarged at angle; opercle with 3 distinct spines, the upper one more distant from center one and slightly more posterior than lower; opercular membrane very obtusely rounded, the upper margin concave.

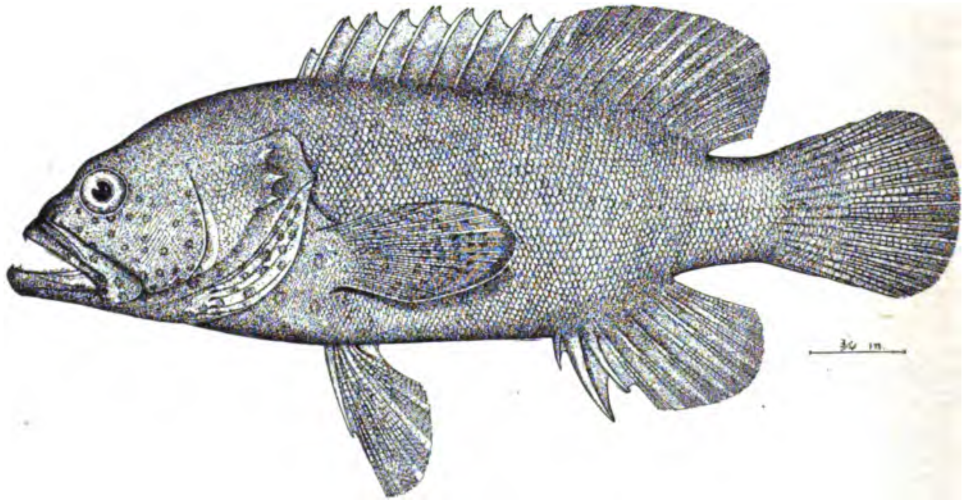

FIG. 11.—*Cephalopholis kendalli* Evermann & Seale, new species. Type

Body covered with fine ctenoid scales; head and nuchal region with cycloid scales; maxillary scaled, the scales on nuchal region and top of head very fine, about 80 in series in front of dorsal; origin of dorsal above base of pectoral, the spines increasing in length posteriorly, the second spine 1.35 in ninth, the first 2.5 in ninth; rays of soft dorsal much longer than spines, the longest ray 2.5 in head; second anal spine longest, 3 in head; longest anal ray 2 in head; origin of anal nearer to base of caudal than to origin of ventrals; pectoral 1.5 in head, tip extending slightly posterior to vent, but not reaching a line with origin of anal fin; ventrals 2 in head, their origin midway between tip of snout and base of sixth anal ray, their tips reaching to, but not beyond, vent; caudal rounded, 1.75 in head.

Color in spirits, dark brown; large scattered blue spots with black margins on head, thorax, belly, and fins except spinous dorsal, which is dusky; no bars or spots on other portions of body, the spots on fins indis, tinct, except on pectoral, where they form rows; pectoral with a slight wash of yellowish with a black margin-otherwise the fins all blackish without a trace of lighter margins.

This species is related to *C. guttatus*, from which it differs in the larger scales, longer ventrals, smaller eye, and in coloration.

One fine specimen from Bacon, no. 55911, U. S. National Museum (B. F. no. 3722), length 7.5,in.; collector Charles J. Pierson.

We take pleasure in naming this species for our associate, Dr. Wm. C. Kendall, of the U. S. Bureau of Fisheries.

114. **Cephalopholis bœnack** (Bloch).

One specimen from Bacon (no. 3856; length 5 in.).

Bodianus bœnack Bloch, Ichth., IV, 31, pl. CCXXVI, 1797.
Epinephelus bœnack, Boulenger, Cat., I, 180.

115. **Cephalopholis obtusauris** Evermann & Seale, new species.

Head 2.55 in length; depth 2.8; eye 5.3 in head; snout 3.9; interorbital 1.75 in snout; dorsal IX, 15; anal III, 9; scales about 12–95–26, with 48 pores in lateral line.

Body oblong, moderately compressed; depth of caudal peduncle 2.95 in head; body and head covered with minute scales with rough margins; lateral line with a distinct curve above pectoral; head large; mouth very large; maxillary 2 in head, its distal end under middle of eye, its width 1.3 in eye; mandible 1.85; small teeth on jaws, vomer, and palatines, outer series on upper jaw slightly enlarged, with 2 canines on each side anteriorly, and with some enlarged depressible teeth posterior to them; a canine on each side of symphysis of lower jaw, with a row of larger depressible teeth among the small ones on sides; 14 gillrakers on lower limb (counting knobs), the longest equal to pupil; preopercle slightly rough; opercle with 3 spines, the lower one a little anterior to the others, the upper one more removed from center one; opercular flap very obtusely rounded, not ending in a sharp point; origin of dorsal fin on a line with axil of pectoral, and midway between tip of snout and base of eighth dorsal ray; longest dorsal spine 3 in head, the anterior spine less than diameter of eye; longest dorsal ray 2.3 in head; origin of anal slightly nearer base of ventral than to base of caudal, and on a line with base of third dorsal ray; base of anal 2.4 in head, its longest ray 2 in head, the second anal spine the strongest and slightly the longest; ventrals 1.75 in head, their tips reaching a little past vent, but not to base of anal fin; pectoral 1.3 in head, the tip on a line with origin of anal fin; caudal rounded, 1.75 in head.

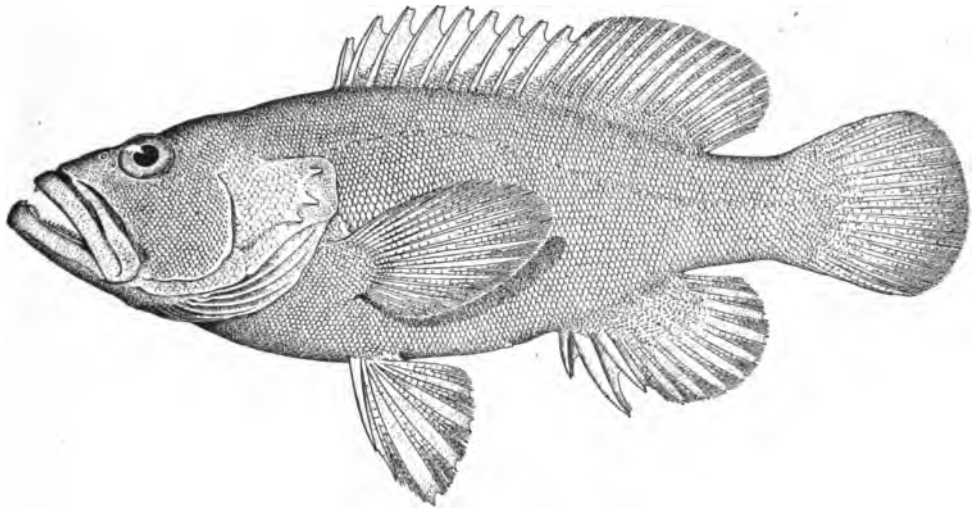

FIG. 12.—*Cephalopholis obtusauris* Evermann & Seale, new species. Type.

Color in spirits, uniform yellowish, with slight wash of dull brown, evidently uniform red in life; fins unmarked.

Related to *C. aurantius* Cuvier & Valenciennes, but with shorter premaxillary and obtuse flap to opercle, and fewer scales in lateral line.

One specimen, the type, no. 55910, U. S. National Museum (Bureau of Fisheries no. 3541; length 9.15 in.) from Bacon, Sorsogon, P. I.; collector Charles J. Pierson.

116. **Cromileptes altivelis** (Cuvier & Valenciennes).

One specimen from Bacon (no. 3763; length 3.75 in.).

Color in spirits, yellowish, the spots brown, large, and sparsely placed.

Serranus altivelis Cuvier & Valenciennes, Hist. Nat. Poiss., II, 241 (324), pl. 35, 1828, **Java.**
Cromileptes altivelis, Bleeker, Atlas, VII, 30, and Atlas, VIII, pl. CCCXXII, fig. 3; Boulenger, Cat., I, 271.

117. **Grammistes sexlineatus** (Thunberg).

One specimen from Bacon (no. 3750; length 3 in.).

Perca sexlineata Thunberg, K. Vetensk. Acad. n. Handl., XIII, 1792, 142, pl. V, **no locality.**
Grammistes sexlineatus, Boulenger, Cat., I, 346.

118. **Psammoperca waigiensis** (Cuvier & Valenciennes).

One small specimen from Bulan (no. 3759; length 1.85 in.).

Labrax waigiensis Cuvier & Valenciennes, Hist. Nat. Poiss., II, 61 (83), 1828, **Waigiou.**
Psammoperca waigiensis, Bleeker, Atlas, VII, 108, pl. CCCVI, fig. 2.
Psammoperca vaigiensis, Boulenger, Cat., I, 365 (Cebu).

119. **Plectropoma calcariferum** (Bloch). *Mulmul.*

One specimen from Zamboanga (no. 4065; length 13.5 in.).

Holocentrus calcarifer Bloch, Ichth., IV, 80, pl. CCXLIV, 1797, **Japan.**
Lates calcarifer, Day, Fishes India, 7, pl. 1, fig. 1; Boulenger, Cat., I, 363.

120. **Pharopteryx nigricans** Rüppell.

One specimen from Bacon (no. 3837; length 1.5 in.).

Pharopteryx nigricans Rüppell, Atlas, Fische, 15, pl. IV, fig. 2, 1828, **Red Sea.**
Plesiops nigricans, Günther, Cat., III, 363; Boulenger, Cat., I, 340.

Family PRIACANTHIDÆ.

121. **Priacanthus hamrur** (Forskål).

One specimen from Bulan (no. 3267; length 7.5 in.).

Head 3 in length; depth 2.75; eye 2.56 in head; snout 3; interorbital 3.75; gillrakers 15 on lower limb of first arch; preopercular spine 2 in pupil; tenth dorsal spine 2.5 in head, or 1.7 times length of second; longest soft rays of dorsal a third longer than longest spine; pectoral 1.9 in head; ventrals 1.1, the spine 1.8; third anal longer than sixth dorsal spine, nearly equal to tenth; dorsal spines smooth, the anal and ventrals spinulose.

Ventrals black on distal third and a black spot in axil; dorsal and anal margined with black.

Boulenger gives the number of gillrakers on lower limb of first arch as 18 to 23. Our specimen has 15. This range is great and may represent 2 or more species.

Sciæna hamrur Forskål, Descr. Anim., 45, 1775, **Red Sea.**
Priacanthus hamrur, Boulenger, Cat., I, 355.

Family LUTIANIDÆ.

122. **Diacope sebæ** Cuvier & Valenciennes.

Three fine specimens from Bulan (no. 4072 to 4074; length 4.75 to 5.25 in.).

Diacope sebæ Cuvier & Valenciennes, Hist. Nat. Poiss., II, 310 (411), 1828, **Waigiou.**
Lutianus sebæ, Day, Fishes India, 30, pl. IX, fig. 3.

123. **Lutianus quinquelineatus** (Bloch).

Five specimens from Bulan (no. 3535, 3311, 3272, 3273, and 3248; length 6 to 6.5 in.), and one from Bacon (no. 3312; length 6.5 in.).

Easily distinguished by the 5 blue stripes along side and the large black blotch under beginning of soft dorsal.

Holocentrus quinquelineatus Bloch, Ichth., iv, 84, tab. ccxxxix, 1797.
Mesoprion quinquelineatus, Cuvier & Valenciennes, Hist. Nat. Poiss., ii, 336 (442) (Java); Günther, Cat., i, 209.
Lutianus quinquelineatus, Day, Fishes India, 40, pl. xii, fig. 3; Bleeker, Atlas, viii, 56, pl. cccxliii, fig. 4.

124. **Lutianus decussatus** (Kuhl & Van Hasselt). *Buegsang.*

Four specimens from Bacon (no. 3954 and 3264 to 3266; length 5.75 to 7 in.).

Easily distinguished by the 5 or 6 broad longitudinal brownish bands, the upper 3 crossed by short vertical bars, and a black spot on base of caudal.

Mesoprion decussatus Kuhl & Van Hasselt in Cuvier & Valenciennes, Hist. Nat. Poiss., ii, 369 (487), 1828, Java; Günther, Cat., i, 210.
Lutianus decussatus, Day, Fishes India, 47, pl. xiv, fig. 4; Bleeker, Atlas, viii, 72, pl. cccxxxviii, fig. 4.

125. **Lutianus monostigma** (Cuvier & Valenciennes).

One specimen from Bacon (no. 3640; length 6.5 in.). No teeth on tongue; dark spot on the lateral line smaller than in *L. johnii*, which has distinct teeth on tongue.

Mesoprion monostigma Cuvier & Valenciennes, Hist. Nat. Poiss., ii, 337 (446), 1828, Seychelles.
Lutianus lioglossus Bleeker, Atlas, viii, 70, pl. cccxliv, fig. 4, Bintang, Java, Celebes, Amboyna.

126. **Lutianus fulviflamma** (Forskål). *Bitilla.*

One specimen from Bacon (no. 4168; length 10.25 in.), and 2 from Zamboanga (no. 3459 and 3443; length 6 and 7 in.).

Sciæna fulviflamma Forskål, Descr. Anim., 45, 1775, Red Sea.
Mesoprion fulviflamma, Günther, Cat., i, 201, in part.
Lutianus fulviflamma, Day, Fishes India, 41, pl. xii, fig. 6; Bleeker, Atlas, viii, 65, pl. cccxliv, fig. 3.

127. **Lutianus johnii** (Bloch). *Bitilla; Manila.*

Two specimens from Jolo (no. 4041 and 4042; length 8 and 10 in.), one from Bacon (no. 4166; length 10 in.), and 2 from Bulan (no. 3539 and 3540; length 5.5 and 6.2 in.).

Readily distinguished by its having the rows of scales parallel with the back; teeth on tongue.

Anthias johnii Bloch, Ichth., ix, 97, pl. cccviii, 1797.
Mesoprion johnii, Günther, Cat., i, 200.
Lutianus johnii, Bleeker, Atlas, viii, 49, pl. cccxxxviii, fig. 3; Day, Fishes India, 42, pl. xiii, fig. 1.

128. **Lutianus luzonius** Evermann & Seale, new species.

Head 2.55 in length; depth 2.55; eye 4 in head; snout 3.1; interorbital 4.8; dorsal x, 14; anal iii, 8; scales 7-48-16; teeth on tongue.

Body oblong, moderately elevated and compressed; dorsal surface evenly curved; depth of caudal peduncle 3.18 in head; jaws equal; maxillary scarcely reaching anterior margin of pupil, its length 2.55 in head; greatest width of premaxillary not more than 2 in pupil; mandible 2.5 in head; preorbital 1.75 in eye; teeth on jaws, vomer, palatines, and tongue, those of jaws in a single series, small, canine-shaped, the anterior ones of upper jaw enlarged; gillrakers 11 on lower limb, the longest about equal to pupil; notch of preopercle very deep and distinct, the lower limb slightly produced backward, rounded, and rather strongly toothed; knob of interopercle large and strong; opercle ending in a single sharp point; origin of dorsal slightly anterior to origin of pectoral, the distance between tip of snout and first dorsal spine scarcely greater than length of head, longest spine 2.7 in head, longest soft ray 3.5; origin of anal midway between origin of ventrals and base of caudal, its base 3.75 in base of dorsal, the longest ray 2.75 in head, the second spine longest and strongest, 2.5 in head; ventrals 1.75 in head, their tips reaching vent; pectoral 1.24, the tip scarcely reaching line with origin of anal; caudal emarginate, 1.3 in head.

Color in spirits, dull yellowish white, with a round black spot about size of eye entirely above lateral line under anterior part of soft dorsal; scales with slightly darker centers, giving an appearance of fine indistinct oblique dusky lines above lateral line and longitudinal ones below; a distinct black spot occupying upper base and axil of pectoral; fins uniform, without marking.

Three fine specimens from Bacon (no. 3229, 3230, 3675; length 5.75 to 6.8 in.). This species is related to *L. russelli* (Bleeker), from which it appears to differ in the deeper preopercular notch, the strong interopercular knob, the long pectoral fin, and in coloration.

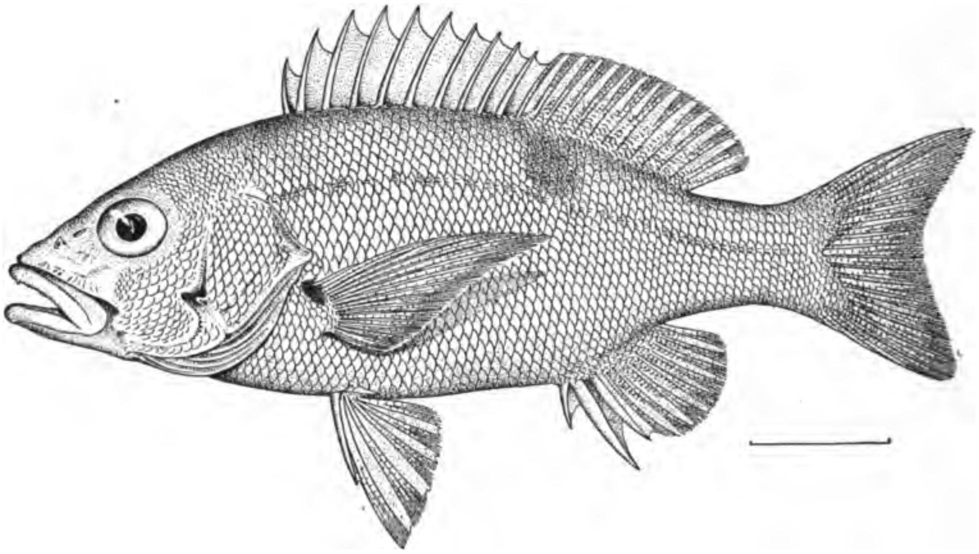

FIG. 13.—*Lutianus luzonius* Evermann & Seale, new species. Type.

Type, no. 55918, U. S. National Museum (original no. 3230), a specimen 6.8 inches long, from Bacon, Sorsogon, P. I.; collector Charles J. Pierson. Cotypes, no. 4539, Bureau of Fisheries, and no. 20003, Stanford University.

129. **Lutianus furvicaudatus** Fowler.

One specimen from Bacon (no. 3785; length 8.5 in.). This species is distinguished from *L. lunulatus* by the shorter maxillary and scarcely perceptible lingual teeth. We have examined Mr. Fowler's type.

Lutianus furvicaudatus Fowler, Journ. Acad. Nat. Sci. Phila., 2d ser., vol. XII, 1904 (June 10), 525, pl. XVIII, lower fig., **Padang.** (Type, 7¾ in. long, no. 27596, Phila. Acad. Nat. Sci.).

130. **Lutianus gibbus** (Forskål).

One specimen from Bacon (no. 4035; length 5 in.).

Sciæna gibba Forskål, Descr. Anim., 46, 1775, **Red Sea.**
Genyoroge gibba, Günther, Cat., I, 180.
Mesoprion gibbus, Günther, Fische der Südsee, 12, taf. 12, 13 (fig. A).

131. **Lutianus erythropterus** Bloch.

One specimen from San Fabian (no. 3343; length 5.8 in.).

Lutianus erythropterus Bloch, Ichth., VII, 93, pl. CCXLIX, 1797, **Japan**; Day, Fishes India, 32, pl. X, figs. 1 and 2; not of Bleeker.
Mesoprion erythropterus, Günther, Cat., I, 205.

132. **Lutianus lunulatus** (Mungo Park).

Five specimens from Bacon (no. 3309, 3310, and 4135 to 4137; length 6.5 to 7.5 in.), and one from Bulan (no. 3517; length 7 in.).

Perca lunulata Mungo Park, Trans. Linn. Soc. Lond., III, 1797, 35, pl. 6, **Sumatra.**
Lutianus lunulatus, Bleeker, Atlas, VII, pl. CCXCV, fig. 1, and Atlas, VIII, 66 (Sumatra; Celebes).

133. **Lutianus vitta** (Quoy & Gaimard). *Bitilla.*

Two specimens from Bacon (no. 3718 and 3719; length 5.75 and 6.1 in.), one from Bulan (no. 3595; length 5 in.), and one from Zamboanga (no. 4096; length 9 in.).

Serranus vitta Quoy & Gaimard, Voy. Uranie, 315, pl. 58, fig. 3, 1824, **Waigiou.**
Diacope vitta Temminck & Schlegel, Fauna Japonica, Pisces, 13, pl. VI, fig. 1.
Lutianus vitta, Day, Fishes India, 46, pl. XIV, fig. 2.

134. **Lutianus lineatus** (Quoy & Gaimard). *Alangot.*

One specimen from San Fabian (no. 4125; length 7.5 in.). This specimen is abnormal, in that it has but 9 dorsal spines; teeth on tongue.

Diacope lineata Quoy & Gaimard, Voy. Uranie, Zool., 309, 1824, **Rawak et Waigiou.**
Mesoprion lineatus, Günther, Cat., I, 193.
Lutjanus lineatus, Bleeker, Atlas, VII, pl. CCCIV, fig. 4, and Atlas, VIII, 69 (East Indies).

135. **Lutianus amboinensis** (Bleeker).

One specimen from Bulan (no. 3226; length 6.95 in.). Dorsal with 11 spines; no teeth on tongue.

Mesoprion amboinensis Bleeker, Nat. Tijds. Ned. Ind., III, 1852, 259, **Amboyna.**
Lutjanus amboinensis Bleeker, Atlas, VII, pl. CCCXVIII, fig. 2, and Atlas, VIII, 57 (East Indies).
Genyoroge amboinensis, Günther, Cat., I, 183 (Amboyna).

136. **Lutianus lineolatus** (Rüppell).

Four specimens from Bacon (no. 3358, 3359, 3361, and 3362; length 6 to 6.5 in.), and 6 from Bulan (no. 3245 to 3247, 3605, and 3596; length 5.75 to 6.1 in.).

Diacope lineolata Rüppell, Atlas, Fische, 76, pl. 19, fig. 3, 1828, **Massaua**; not of Bleeker.
Mesoprion lineolatus, Günther, Cat., I, 205.
Lutianus lineolatus, Day, Fishes India, 35, pl. XI, figs. 1 and 2.

137. **Lutianus malabaricus** (Bloch & Schneider).

One small specimen (no. 4006; length 1.75 in.), from Bulan, probably the young of this species.

Sparus malabaricus Bloch & Schneider, Syst. Ichth., 278, 1801, **"in mari Indico."**
Lutianus malabaricus, Day, Fishes India, 31, pl. IX, fig. 4.

138. **Gymnocranius lethrinoides** (Bleeker).

Three specimens from Bulan (no. 4046 to 4048; length 4.5 to 6 in.).

Dentex lethrinoides Bleeker, Sparoiden, 11, Verh. Bat. Gen., XXIII, 1850, **Batavia.**
Gymnocranius lethrinoides Bleeker, Atlas, VIII, 96, pl. CCCXXXII, fig. 1, and pl. CCCXXXIV, fig. 3.

139. **Pinjalo typus** (Bleeker).

One specimen from San Fabian (no. 3344; length 6.5 in.), and one from Bulan (no. 4038; length 11.5 in.).

Cæsio typus Bleeker, Mænoiden, 10, Verh. Bat. Gen., XXIII, 1850, **Batavia**; Day, Fishes India, 94, pl. XXIV, fig. 4; Günther, Cat., I, 391; Bleeker, Atlas, VII, pl. CCXCIII, fig. 3, and Atlas, VIII, 33.

140. **Nemipterus nemurus** (Bleeker). *Pukit.*

Two specimens from Jolo (no. 3748 and 3778; length, with caudal filament, 12.5 and 13.5 in.).

Dentex nemurus Bleeker, Amboina, 49; Act. Soc. Sci. Ind. Neerl., II, 1857; Atlas, VIII, 87, pl. CCCXXXV, fig. 4, **Amboyna.**
Synagris nemurus, Günther, Cat., I, 378.

141. **Nemipterus worcesteri** Evermann & Seale, new species.

Head 3.45 in length; depth 3.75; eye 3.75 in head; snout 2.5; interorbital 1.9 in snout; dorsal x, 9; anal 9; scales 4-48-11.

Body oblong, moderately compressed; depth of caudal peduncle 3.35 in head; anterior profile of head not evenly rounded, being somewhat convex in front of eye; mouth rather large, the lower jaw slightly the longer;

maxillary 2.85 in head; mandible 3; distal end of maxillary not reaching to below anterior border of eye; preorbital 3.75; bands of small teeth in jaws, with small canines anteriorly, and a row of slightly enlarged curved teeth in each side; gillrakers represented by wide blunt knobs, 7 on lower limb; body covered by thin delicate scales, 3 rows on cheek; preopercle entire; opercle with a single spine at posterior margin; origin of dorsal on line with origin of pectoral, longest dorsal spine 2.1 in head, the longest ray 2.5; webs of dorsal fin scarcely incised; origin of anal slightly nearer origin of ventral than base of caudal, its longest ray 3.25 in head; base of anal 2.95 in base of dorsal; ventrals 1.4 in head, their origin below pectoral, their tips not reaching vent; pectoral 1.45 in head; caudal forked; none of the fins with elongate rays.

Color in spirits, yellowish white with slight tint of brown above; no stripes; a wide deep black band entirely encircling caudal peduncle, the black extending out slightly on upper and lower rays of caudal.

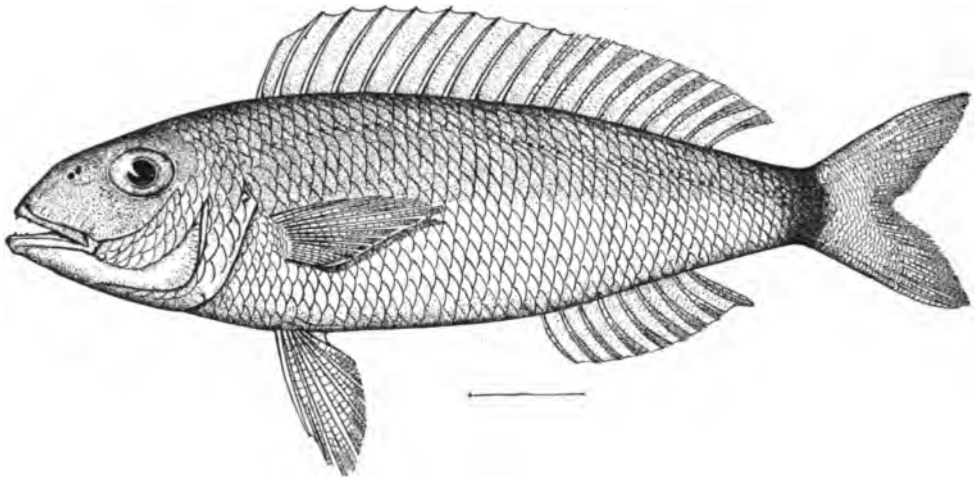

FIG. 14.—*Nemipterus worcesteri* Evermann & Seale, new species. Type.

One specimen (no. 4124; length 8.5 in.), from Bacon, Sorsogon, P. I., type no. 55917, U. S. National Museum; collector Charles J. Pierson.

We take pleasure in naming this species for the Hon. Dean C. Worcester, of the Philippine Commission, in recognition of his valuable work in promoting the study of the zoology of the Philippine Islands.

142. **Nemipterus tæniopterus** (Cuvier & Valenciennes). *Baga.*

One specimen from San Fabian (no. 3512; length 8 in.).

Dentex tæniopterus Cuvier & Valenciennes, Hist. Nat. Poiss., VI, 183 (246), **locality unknown.**
Synagris tæniopterus, Günther, Cat., I, 374 (N. E. coast of Australia; Molucca Sea).

143. **Nemipterus japonicus** (Bloch).

One specimen from San Fabian (no. 3436; length 7.5 in.).

Sparus japonicus Bloch, Ichth., pl. CCLXXVII, fig. 1.
Dentex blochi Bleeker, Nat. Tijds. Ned. Ind., II, 1851, 176, **Batavia**; Atlas, VIII, 90, pl. CCCXXX, fig. 4.
Synagris japonicus, Günther, Cat., I, 378; Day, Fishes India, 92, pl. XXIV, fig. 2.

144. **Nemipterus ovenii** (Bleeker).

Two specimens from Bulan (no. 3371 and 3372; length 6.25 and 7.5 in.).

Dentex ovenii Bleeker, Nat. Tijds. Ned. Ind., VII, 1854, 246, **Celebes**; Atlas, VIII, 86, pl. CCCXXVIII, fig. 5.
Synagris ovenii, Günther, Cat., I, 375.

145. **Cæsio cuning** (Bloch).

Fifteen specimens from Bacon (no. 3624 to 3636, 3400 to 3402, 3641, 3642, 3654 to 3657, 3486 to 3488, 4044 and 4045; length 4.75 to 10 in.) and one from Zamboanga (no. 4043; length 10 in.).

Sparus cuning Bloch, Ichth., pl. cclxiii, fig. 1.
Cæsio cuning, Day, Fishes India, 95.

146. **Cæsio cærulaurens** (Lacépède). *Sulik.*

Eighteen specimens from Bacon (no. 3481 to 3485, 3543 to 3548, 3473, 3474, 3985, and 4114 to 4117; length 4.75 to 8 in.), one from Zamboanga (no. 3419), and one from San Fabian (no. 3708).

Cæsio cærulaurens Lacépède, Hist. Nat. Poiss., iii, 86, 1829; Günther, Cat., i, 392; Bleeker, Atlas, viii, 39, pl. cccxlvii, fig. 4.

147. **Cæsio chrysozona** Kuhl & Van Hasselt.

Ten specimens from Bacon (no. 3702 to 3707, 4010, 4011, 3930, and 3931; length 5 to 6 in.).

Cæsio chrysozona Kuhl & Van Hasselt in Cuvier & Valenciennes, Hist. Nat. Poiss., vi, 331 (440) **Indian Archipelago**; Günther Cat., i, 392; Day, Fishes India, 95, pl. xxiv, fig. 5.

Family HÆMULIDÆ.

148. **Terapon jarbua** (Forskål). *Bungao; Siran banlaonon; Belaque.*

Two specimens from Bulan (no. 4104 and 4105; length 5 and 7 in.) and 3 from San Fabian (no. 3261 3265, and 4145; length 4 to 7 in.).

Sciæna jarbua Forskål, Descr. Anim., 50, 1775, **Red Sea.**
Therapon servus, Günther, Cat., i, 278.
Therapon jarbua, Day, Fishes of India, 69, pl. xviii, fig. 4.

149. **Terapon puta** Cuvier & Valenciennes. *Dacoson.*

Twenty specimens from Bulan (no. 3695; length 2.1 to 2.75 in.), 60 from Bacon (no. 3701; length 2 to 2.45 in.), and 2 from San Fabian (no. 3738 and 3838; length 4.75 and 5.1 in.).

Therapon puta Cuvier & Valenciennes, Hist. Nat. Poiss., iii, 98 (131) **East Indies**; Day, Fishes India, 68, pl. xviii, fig. 3.
Therapon ghebul Ehrenberg in Cuvier & Valenciennes, Hist. Nat. Poiss., iii, 99 (133); Günther, Cat., i, 281.
Therapon trivittatus, Günther Cat., i, 280.

150. **Terapon quadrilineatus** (Bloch). *Dacoson; Agaac.*

Twenty specimens from Bulan (no. 4198 and 3708; length 2.1 to 2.75 in.) and 2 specimens from San Fabian, (no. 3827 and 3975; length 5.75 in.). Ventrals reaching vent.

Holocentrus quadrilineatus Bloch, Ichth., vii, 63, pl. ccxxxviii, fig. 2, 1797, **no locality.**
Therapon quadrilineatus, Günther, Cat., i, 282; Day, Fishes India, 70, pl. xviii, fig. 5.

151. **Terapon theraps** (Cuvier & Valenciennes).

Five specimens from Bulan (no. 4200; length 2.1 in.) and 1 from Bacon (no. 4199; length 2.75 in.). In this species the ventrals do not reach the vent, which is located midway between base of caudal and origin of ventrals. In *T. quadrilineatus* the ventrals reach the vent, which is located much nearer to origin of ventrals than to base of caudal.

Therapon theraps Cuvier & Valenciennes, Hist. Nat. Poiss., iii, 97 (129), pl. 53; Günther, Cat., i, 274; Day, Fishes India, 70, pl. xviii, fig. 6.

152. **Pomadasis maculatus** (Bloch). *Lacsagu.*

Four specimens from San Fabian (no. 3334, 3335, 3337, and 3338; length 6 to 7 in.).

Anthias maculatus Bloch, Ichth., x, 7, pl. cccxxvi, fig. 2, 1797, **East Indies.**
Pristipoma maculatum, Günther, Cat., i, 293 (Torres Strait; Amboyna); Bleeker, Atlas, vii, pl. cccviii, fig. 2.
Pomadasys maculatus, Bleeker, Atlas, viii, 27.

153. **Pentapus caninus** (Cuvier & Valenciennes).

Three specimens from Bacon (no. 3935, 3936, and 3847; length 4.9 to 5.5 in.). Head 3.5 in length; depth 3.6; scales 3–44–12; dorsal x, 9; anal iii, 7.

Scolopsides caninus Cuvier & Valenciennes, Hist. Nat. Poiss., v, 266 (354), **New Guinea.**
Scolopsis caninus, Günther, Cat., i, 364.
Pentapus bifasciatus Bleeker, Atlas, vii, 103, pl. ccxcv, fig. 5.

154. **Pentapus setosus** Cuvier & Valenciennes. *Bakutut.*

Two specimens from Bulan (no. 3844 and 3846; length 5 and 5.1 in.) and 1 from Jolo (no. 3204; length 7.95 in.). Dorsal x, 9; anal iii, 7; scales 45; depth 3.1; head 3.1. Small specimens show a dark spot at base of caudal.

Pentapus setosus Cuvier & Valenciennes, Hist. Nat. Poiss., vi, 200 (270), **Batavia**; Günther, Cat., i, 382; Bleeker, Atlas, viii, 101, pl. cccxxiv, fig. 1.

155. **Plectorhynchus pictus** (Thunberg).

One specimen from Bulan (no. 4142; length 7 in.), and one from Jolo (no. 4068; length 9 in.).

Perca picta Thunberg, K. Vetensk. Acad. n. Handl., xiii, 143, pl. 5, 1792, **no locality.**
Diagramma pictum, Günther, Cat., i, 327.
Plectorhynchus pictus, Bleeker, Atlas, viii, 24, pl. cccxxix, fig. 4.

156. **Plectorhynchus chrysotænia** (Bleeker).

Two small specimens from Bulan (no. 4201; length 2 and 3.2 in.).

Diagramma chrysotænia Bleeker, Nat. Tijds. Ned. Ind., ix, 1855, 303, **Celebes.**
Plectorhynchus chrysotænia, Bleeker, Atlas, viii, 16, pl. cccxxix, fig. 1; Günther, Cat., i, 333.

157. **Plectorhynchus goldmanni** (Bleeker). *Manila.*

One specimen from Jolo (no. 3219; length 8 in.), and one from San Fabian (no. 4150; length 7 in.).

Diagramma goldmanni Bleeker, Nat. Tijds. Ned. Ind., iv, 602, 1853, **Ternate**; Günther, Cat., i, 331.
Plectorhynchus goldmanni Bleeker, Atlas, viii, 21, and Atlas, vii, pl. ccxcv, fig. 2.

158. **Plectorhynchus celebicus** Bleeker. *Kiting.*

Two specimens from Jolo (no. 4064; length 2.5 and 10.5 in.). This species is easily distinguished from *P. chrysotænia*, in which the caudal is not notched.

Plectorhynchus celebicus Bleeker, Ned. Tijds. Dierk., iv, 1873, 285, **Celebes**; Atlas, viii, 18, pl. cccxxix, fig. 3.

159. **Scolopsis cancellatum** (Cuvier & Valenciennes).

Two specimens from Bacon (no. 3420 and 3887; length 4.2 and 6.75 in.), and 2 from Bulan (no. 3209 and 4071; length 6.1 and 6.2 in.).

Scolopsides cancellatus Cuvier & Valenciennes, Hist. Nat. Poiss., v, 264 (351), 1830, **Sandwich Islands, Waigiou and Rauwac.**
Scolopsis cancellatus, Günther, Cat., i, 361 (Sumatra); Day, Fishes India, 86, pl. xxii, fig. 6.

160. **Scolopsis bilineatum** (Bloch).

One specimen from Bulan (no. 3875; length 5.75 in.).

Anthias bilineatus Bloch, Ichth., x, 1, pl. cccxxv, fig. 1, 1797, **Japan.**
Scolopsis bilineatus, Günther, Cat., i, 357 (Amboyna; Celebes); Day, Fishes India, 85, pl. xxii, fig. 3 (Andamans).

161. **Scolopsis margaritiferum** (Cuvier & Valenciennes).

Four specimens from Bacon (no. 3736, 3360, 3537, and 3499; length 7.5 to 8 in.), and 2 from Bulan (no. 4134 and 3796; length 7.5 and 8.2 in.). Depth 2.5; head 3.2; dorsal x, 9; anal iii, 7; scales 37.

Scolopsides margaritifer Cuvier & Valenciennes, Hist. Nat. Poiss., v, 254 (337), **Waigiou.**
Scolopsis margaritifer, Günther, Cat., i, 355; Bleeker, Atlas, vii, pl. cccxvii, fig. 2, and Atlas, viii, 3.

162. **Scolopsis luzonia** Jordan & Seale.

Thirteen specimens from Bacon (no. 3730 to 3733, 3403 to 3406, 3829 to 3831, 4001 and 4017; length 4 to 6 in.), and one from San Fabian (no. 3332). A prominent serrated ridge on maxillary.

Scolopsis luzonia Jordan & Seale, Bull. Bu. Fisheries, xxvi, 1906, Cavite, Luzon. (Collected by Dr. Lung; type, no. 9243, Stanford Univ.).

163. **Scolopsis monogrammus** (Kuhl & Van Hasselt).

One specimen from Bulan (no. 3277; length 5.85 in.).

Head 3 in length; depth 2.8; eye 3.5 in head; snout 3; interorbital equals eye; scales 5-48-11, 6 rows on cheek.

Color in spirits, yellowish; an indistinct dusky band almost width of eye from head to caudal.

This species is close to *S. personatus*, from which it differs in the greater depth, narrower interorbital, smaller scales, and in having 6 rows of scales (instead of 5) on the cheek.

Scolopsides monogramma Kuhl & Van Hasselt in Cuvier & Valenciennes, Hist. Nat. Poiss., v, 254 (338) Java; Günther, Cat., I, 358.

Scolopsis monogramma, Bleeker, Atlas, VIII, 11, pl. CCCXXXV, fig. 3.

164. **Scolopsis bulanensis** Evermann & Seale, new species.

Head 3.25 in length; depth 3.3; eye 2.75 in head; interorbital 3.5; snout 3.55; dorsal X, 9; anal III, 7; scales 4-43-10.

Body oblong, moderately compressed; depth of caudal peduncle 3 in head; anterior profile of head slightly convex above eyes; mouth rather small, jaws equal; maxillary 3.75 in head, its distal end not reaching to anterior margin of orbit; mandible 2.95 in head; teeth villiform in jaws and on vomer; preorbital width 3 in eye, with one strong spine above and 2 smaller ones below, the large one reaching slightly past middle of eye; gillrakers consisting of blunt knobs, about 7 on lower arch; posterior margin of preopercle denticulate; opercle with a single spine at its posterior margin; body fully scaled, 5 series on cheek; scales on top of head minute, those on belly larger; vertical fins unscaled, but fitting into scaly sheath; origin of dorsal slightly posterior to origin of pectoral, longest spine 2.75 in head, longest ray 2.75; origin of anal nearer origin of ventrals than to base of caudal, its longest ray 2.7 in head, the second anal spine longest and strongest, 2.5 in head, base of anal 3.6 in base of dorsal; ventrals 1.3 in head, their tip falling far short of anal; pectoral 1.35 in head, scarcely reaching tip of ventrals; caudal forked.

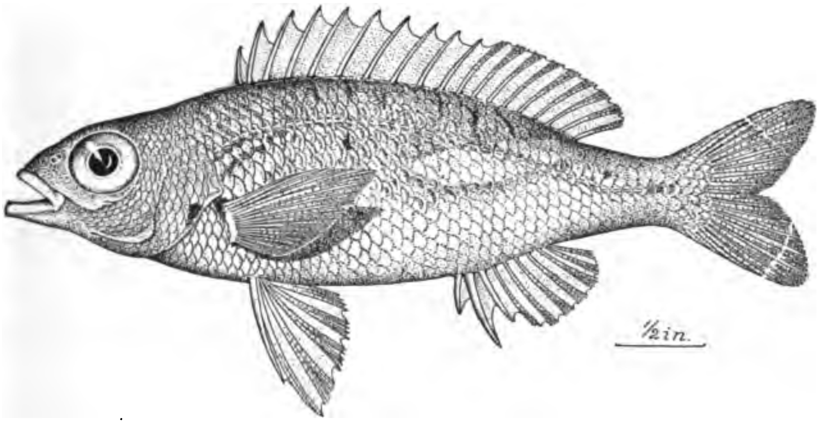

FIG. 5.—*Scolopsis bulanensis* Evermann & Seale, new species. Type.

Color in spirits, dull yellowish brown; an indistinct dusky longitudinal line on side; short oblique black lines between pectoral fin and lateral line; an oblong white blotch extending forward and downward from posterior axil of dorsal to near middle of body; a black spot at axil of pectoral, another on posterior portion of opercle just in front of pectoral; fins unmarked.

This species is related to *S. personatus*, from which it differs in the larger eye, more slender body, and the color.

One specimen, the type, no. 55909, U. S. National Museum (original no. 3845), 4.25 inches long, from Bulan, Sorsogon, P. I.; collector Charles J. Pierson.

Family SPARIDÆ.

165. **Sparus calamara** Russell.

One specimen from Bulan (no. 3258; length 6.5 in.). Pectoral longer than head; ventrals reaching past vent.

Sparus calamara Russell, Fishes Coromandel, i, pl. 92, 1803, **Coromandel**.
Chrysophrys calamara, Cuvier & Valenciennes, Hist. Nat. Poiss., vi, 85 (117); Günther, Cat., i, 493.
Chrysophrys berda var. *calamara*, Day, Fishes India, 140, pl. xxxv, fig. 2 (Sind and Malabar).

166. **Lethrinus nematacanthus** Bleeker.

Three specimens from Bulan (no. 3457, 3458, and 3946; length 4.75 to 6 in.). This species is easily distinguished by the elongate second dorsal spine which is contained 1.5 in head. A black spot between pectoral and lateral line.

Lethrinus nematacanthus Bleeker, Ichth. Japon., 90, Verh. Bat. Gen., xxvi, 1854, **Japan**; Bleeker, Atlas, viii, 114, pl. cccxxxvii, fig. 3; Günther, Cat., i, 456 (Louisiade Archipelago).

167. **Lethrinus richardsoni** Günther.

Twenty-five specimens from Bacon (no. 3205 to 3208, 3236, 3237, 3238, 3313, 3317 to 3323, 3329 to 3341, 3527 to 3530, 3820, 3821, and 3967; length 3.75 to 6.5 in.).

Lethrinus hæmatopterus, Richardson, Voy. Sulphur, 144, pl. 64, fig. 1; not of Temminck & Schlegel.
Lethrinus richardsonii Günther, Cat., i, 456, 1859, **China**; **Hongkong**; Jordan & Evermann, Proc. U. S. Nat. Mus., xxv, 1903, 350 (Formosa).

168. **Lethrinus mœnsii** Bleeker.

Four specimens from Bacon (no. 3526, 3452, 3934, and 3969; length 4.5 to 6.5 in.).

Lethrinus mœnsii Bleeker, Nat. Tijds. Ned. Ind., ix, 1855, 435, **Batjan**; Bleeker, Atlas, vii, pl. ccxcvii, fig. 3, and Atlas, viii, 115; Günther, Cat., i, 455 (Copang; Timor; Louisiade Archipelago); Fische der Südsee, 64, pl. 46, fig. a (Paumotu; Harvey; Pelew; Kingsmill; Society Islands).

169. **Lethrinus variegatus** Ehrenberg.

One specimen from San Fabian (no. 3326; length 6.5 in.). Known by its slender body, long snout, and peculiar conical lateral teeth.

Lethrinus variegatus Ehrenberg in Cuvier & Valenciennes, Hist. Nat. Poiss., vi, 213 (287), **Massauah, Suez**; Bleeker, Atlas, vii, pl. cccxvii, fig. 1, and Atlas, viii, 117, pl. cccxxviii, fig. 3, and pl. cccxxx, fig. 2.

170. **Lethrinus hypselopterus** Bleeker.

One specimen from "Philippine Islands" (no local label, no. 4169; length 10.2 in.).

Head 3 in length; depth 2.6; eye 4 in head; snout 2; preorbital 2.4; scales 6–46–14; dorsal x, 9; anal iii, 7; pectoral nearly as long as head.

Lethrinus hypselopterus Bleeker, Nat. Tijds. Dierk., iv, 326, **Sumatra**; Atlas, viii, 114, pl. cccxxx, fig. 3.

171. **Lethrinus harak** (Forskål). *Bakutut.*

One specimen from Jolo (no. 4109; length 9 in.), 9 from Bacon (no. 3316, 3453 to 3456, 3970, 3968 and 3525; length 2.25 to 6.75 in.), and 2 from San Fabian (no. 3338; length 2.5 and 2.75 in.).

Sciæna harak Forskål, Descr. Anim., 52, 1775, **Red Sea**.
Lethrinus harak, Günther, Cat., i, 458 (Red Sea); Bleeker, Atlas, viii, 119, pl. cccxxvii, fig. 3; Day, Fishes of India, 137, pl. xxx, fig. 3.

172. **Lethrinus ornatus** Cuvier & Valenciennes.

One specimen from Bulan (no. 3862; length 1.95 in.).

Lethrinus ornatus Cuvier & Valenciennes, Hist. Nat. Poiss., vi, 231 (310), **Java**; Bleeker, Atlas, viii, 118, pl. cccl, fig. 4.

Lethrinus xanthotænia Bleeker, Nat. Tijds. Ned. Ind., ii, 1851, 176, **Sumatra**; Günther, Cat., i, 461.

173. **Lethrinus mahsenoides** Ehrenberg.

One specimen from Philippines (no local label, no. 4167; length 10.2 in.).

Lethrinus mahsenoides Ehrenberg in Cuvier & Valenciennes, Hist. Nat. Poiss., vi, 212 (286), **no locality given**; Günther, Cat., i, 464 (Philippines; Amboyna); Bleeker, Sparoiden., 15, Ver. Bat. Gen., xxiii, 1850.

Family SCIÆNIDÆ.

174. **Umbrina dussumieri** Cuvier & Valenciennes. *Ibot.*

Five specimens from San Fabian (no. 4097 to 4101; length 4 to 5.25 in.).

Umbrina dussumieri Cuvier & Valenciennes, Hist. Nat. Poiss., ix, 355 (481), **Coromandel**; Günther, Cat., ii, 278; Bleeker, Atlas, ix, pl. ccclxxxvii, fig. 4; Day, Fishes of India, 183, pl. xliii, figs. 2 and 3.

175. **Umbrina russelli** Cuvier & Valenciennes. *Belaque.*

Three specimens from San Fabian (no. 3268 to 3270; length 4.75 and 6.1 in.).

Umbrina russelli Cuvier & Valenciennes, Hist. Nat. Poiss., v, 132 (178), **Coromandel**; Günther, Cat., i, 278; Day, Fishes of India, 183, pl. xliii, fig. 4.

Sciæna russelli Bleeker, Atlas, ix, pl. ccclxxxvi, fig. 2.

176. **Otolithus argenteus** Kuhl & Van Hasselt.

One specimen from Bacon (no. 3441; length 9 in.).

Otolithus argenteus Kuhl & Van Hasselt in Cuvier & Valenciennes, Hist. Nat. Poiss., v, 47 (62), **Batavia**; Günther, Cat., ii, 310; Bleeker, Atlas, ix, pl. ccclxxxv, fig. 5.

177. **Johnius belengeri** (Cuvier & Valenciennes). *Ibot.*

One specimen from San Fabian (no. 3709; length 7.75 in.).

Corvina belengerii Cuvier & Valenciennes, Hist. Nat. Poiss., v, 89 (120); Günther, Cat., ii, 303 (Malabar).

Johnius belengeri, Bleeker, Atlas, ix, pl. ccclxxxvii, fig. 1.

Family SILLAGINIDÆ.

178. **Sillago macrolepis** Bleeker.

Two specimens from Bulan (no. 4094 and 4095; length 7.25 and 8 in.). Eye 4 in head, 1.75 in snout; snout 2.35 in head; scales about 60.

Sillago macrolepis Bleeker, Nat. Tijds. Ned. Ind., xvii, 1858, 166, **Bali**, and Atlas, ix, pl. ccclxxxix, fig. 1; Günther, Cat., ii, 246.

Family MULLIDÆ.

179. **Mulloides vanicolensis** (Cuvier & Valenciennes).

Two specimens from Zamboanga (no. 4090 and 4091; length 9 and 10 in.).

Upeneus vanicolensis Cuvier & Valenciennes, Hist. Nat. Poiss., vii, 391 (521), **Vanicolo**.

Mulloides vanicolensis, Jordan & Evermann, Bull. U. S. Fish Comm., xxiii, pt. i, 1903 (July 29, 1905), 254.

180. **Mulloides samoensis** Günther. *Tubac.*

One specimen from San Fabian (no. 4130; length 5.55 in.) and one from Bacon (no. 4131; length 6.25 in.). This species is easily distinguished by the black spot on side under posterior end of pectoral.

Mulloides samoensis Günther, Fische der Südsee, 57, pl. 43, fig. b, **Apia, Samoa**; Jordan & Evermann, Bull. U. S. Fish Comm., xxiii, 1903, 253, fig. 105 (Oahu Island; Hilo).

181. **Mulloides japonicus** (Houttuyn).

Four specimens from Bulan (no. 3901 to 3904; length 4.75 in.). Head 3.5 in length; depth 3.85; scales 30; 3 or 4 dusky oblique bands on caudal, almost obliterated on lower lobe, an indistinct dusky line on side from head to caudal.

No difference can be detected in these specimens when compared with specimens from Japan.

Mullus japonicus Houttuyn, Verh. Holl. Maat. Weet. Haarlem, xx., deels, 2 stuk, 1782, p. 311–346, **Nagasaki.**
Mulloides japonicus, Günther, Cat., i, 404; Snyder, Proc. U. S. Nat. Mus., xxxi, 1906, 552 (Misaki).
Upeneus japonicus, Cuvier & Valenciennes, Hist. Nat. Poiss., iii, 339 (460), 1829 (Japan).

182. **Upeneus tragula** Richardson.

Three specimens from Bacon (no. 3634 to 3636; length 5.25 to 6.5 in.).

Upeneus tragula Richardson, Ichth. China, in Rept. Brit. Assoc., xv, 1845, 220, **Canton**; Günther, Cat., i, 398.

183. **Upeneus sulphurus** Cuvier & Valenciennes. *Belaque.*

Six specimens from San Fabian (no. 3921; length 3.5 in.).

Upeneus sulphurus Cuvier & Valenciennes, Hist. Nat. Poiss., iii, 331 (450), **Antjer.**
Upeneoides sulphureus, Günther, Cat., i, 398.

184. **Upeneus sundaicus** (Bleeker).

One specimen from Bacon (no. 3201; length 5.1 in.). Head 3.5 in length; depth 3.75; eye 4 in head; interorbital 4; scales 2–32–5; dorsal viii, 9; anal ii, 6; teeth in villiform bands on jaws, palatines, and vomer, those on vomer very minute, easily overlooked, possibly sometimes absent. Color in spirits yellowish, an indistinct dark longitudinal line from eye to caudal; fins unmarked.

Upeneoides sundaicus Bleeker, Nat. Tijds. Ned. Ind., viii, 1855, 411, **East Indies**, and Atlas, ix, pl. cccxciv, fig. 2; Günther, Cat., i, 399.

185. **Pseudupeneus moana** Jordan & Seale.

One specimen from Bacon (no. 3249; length 9 in.).

Upeneus trifasciatus Günther, Fische der Südsee, 59, pl. 44, fig. b (Vavau; Samoa; Amboyna); not of Lacépède
Pseudupeneus moana Jordan & Seale, Fishes of Samoa, Bull. Bu. Fisheries, xxv, 1905 (1906), 274, **Samoa.**

186. **Pseudupeneus bifasciatus** (Lacépède). *Pinovugnan.*

One specimen from Bacon (no. 3275; length 8.75 in.).

Mullus bifasciatus Lacépède, Hist. Nat. Poiss., iii, 404, pl. 14, fig. 2, 1801, **no locality.**
Pseudupeneus bifasciatus, Jordan & Evermann, Bull. U. S. Fish. Comm., xxiii, 1903, 258, fig. 107 (Hawaiian Islands)

187. **Pseudupeneus barberinus** (Lacépède).

One specimen from San Fabian (no. 3972; length 5.2 in.) and one from Bacon (no. 3886; length 4.75 in.).

Mullus barberinus Lacépède, Hist. Nat. Poiss., iii, 406, pl. 13, fig. 3, 1801.
Upeneus barberinus, Günther, Cat., i, 405 (Amboyna; Moluccas; India).

188. **Pseudupeneus indicus** (Shaw). *Tiao.*

Three specimens from Bacon (no. 3615, 3616, and 4108; length 5.5 to 6.5 in.) and one from Bulan (no. 3672; length 7.75 in.).

Mullus indicus Shaw, Zool., iv, pt. 2, 614, 1803, **Indian Seas.**
Upeneus indicus, Günther, Cat., i, 406 (China).

189. **Pseudupeneus spilurus** (Bleeker).

One specimen from Bulan (no. 3861; length 4 in.). This species has a distinct black spot on caudal peduncle above the lateral line and a dusky blotch at the anterior origin of lateral line.

Upeneus spilurus Bleeker, Nat. Tijds. Ned. Ind., vi, 395, 1854, **Nagasaki**; Günther, Cat., i, 406.

190. **Pseudupeneus luteus** (Cuvier & Valenciennes).

One specimen from Jolo (no. 4141; length 7.5 in.). Head 3.1 in length; depth 3.51; eye 5 in head; snout 2; scales 30; barbels short, not reaching base of ventral. Color in spirits, uniform yellow, no saddle over caudal peduncle.

Upeneus luteus Cuvier & Valenciennes, Hist. Nat. Poiss., VII, 392 (521), Ile de France; Day, Fishes of India, 125, pl. XXXI, fig. 2.
Parupeneus luteus, Bleeker, Atlas, IX, pl. CCCXCIV, fig. 1.

Family POMACENTRIDÆ.

191. **Pomacentrus trimaculatus** Cuvier & Valenciennes. *Bitilla.*

Two specimens from Bacon (no. 3798 and 3790; length 5.25 in.) and one from San Fabian (no. 3972).

Pomacentrus trimaculatus Cuvier & Valenciennes, Hist. Nat. Poiss., V, 320 (427), no locality; Günther, Cat., IV, 19; Day, Fishes of India, 382, pl. LXXX, fig. 10.
Dischistodus trimaculatus, Bleeker, Atlas, IX, pl. CCCCIV, fig. 5.

192. **Pomacentrus jerdoni** Day.

Thirteen specimens from Bulan (no. 3391 to 3399 and 3786 to 3789; length 3.75 to 6 in.).

These agree with Day's description in every respect. They have 13 dorsal spines, a black spot on upper axil of pectoral, the lateral line discontinued under posterior end of soft dorsal, and not continued on caudal peduncle, as in *P. tapeinosoma,* which has only 12 dorsal spines.

Pomacentrus jerdoni Day, Fishes of India, 383, pl. LXXX, fig. 7, Madras.

193. **Pomacentrus moluccensis** Bleeker.

One specimen from Bacon (no. 3895; length 2.75 in.). Color yellowish brown; a small black spot at origin of lateral line, another in upper axil of pectoral.

Pomacentrus moluccensis Bleeker, Nat. Tijds. Ned. Ind., IV, 1853, 118, Amboyna, and Atlas, IX, pl. CCCCII, fig. 3 (Molucca) Günther, Cat., IV, 30.

194. **Pomacentrus littoralis** Kuhl & Van Hasselt. *Kiting.*

Two specimens from Bacon (no. 3896 and 3852; length 4 in.). Preopercle and preorbital strongly serrated. Color in spirits, brownish, including all the fins; a small dusky spot at origin of lateral lines; some bluish markings on head.

This species is similar to *P. moluccensis* in some respects, but the latter is a deeper fish, considerably lighter in color, with a black spot in axil of pectoral.

Pomacentrus littoralis Kuhl & Van Hasselt in Cuvier & Valenciennes, Hist. Nat. Poiss., V, 318 (425), Java; Bleeker, Atlas IX, pl. CCCCIV, fig. 8; Günther, Cat., IV, 32 (Amboyna; Dove Island; Port Essington).

195. **Pomacentrus tripunctatus** Cuvier & Valenciennes.

Eleven specimens from Bacon (no. 3679 and 3681 to 3690; length 2.5 to 3.5 in.).

These specimens are all uniform brownish in color, the caudal scarcely lighter; a distinct round black spot on top of caudal peduncle posterior to axil of soft dorsal fin; preopercle and preorbital denticulate. Our specimens agree with Bleeker's figure, except that they are not quite so deep, the depth being 2.2 in length without caudal; preorbital distinctly serrate.

Pomacentrus tripunctatus Cuvier & Valenciennes, Hist. Nat. Poiss., V, 315 (421), Vanicolo; Günther, Cat., IV, 33.
Pomacentrus trilineatus, Günther, Cat., IV, 25; Bleeker, Atlas, IX, pl. CCCCVI, figs. 1-6.

196. **Pomacentrus tæniurus** Bleeker.

One specimen from Philippine Islands (no local label; no. 3998; length 2.75 in.).

Preopercle but slightly denticulate. A black spot at beginning of lateral line; posterior part of soft dorsal whitish—probably yellow in life.

Pomacentrus tæniurus Bleeker, Act. Soc. Sc. Ind. Ned., I, Amboina, 51, 1856, Amboyna; Atlas, IX, pl. CCCCVIII, fig. 2; Günther, Cat., IV, 22.

197. **Pomacentrus popei** Evermann & Seale, new species.

Head 3 in length; depth 1.9; eye 2.8 in head; snout 3.5; interorbital 2.75; dorsal XIII, 12; anal II, 13; scales 3-24-9.

Body elevated, compressed; depth of caudal peduncle 2 in head; anterior profile evenly rounded; jaws equal; a single series of blunt, rather strong teeth in each jaw, none on vomer or palatines; gillrakers sharp, 13 on lower limb, the longest equal to one-half eye; maxillary not reaching anterior margin of eye, its length equal to eye; mandible 2.75 in head; greatest preorbital width 2 in eye, its margin denticulate with a rather strong spine below anterior third of eye; preopercle strongly denticulate; opercle with a single spine on its posterior margin; body and head fully covered with firm pectinate scales; no scales on preorbital, about 3 rows of scales on cheek; scales on top of head small, about 20 series in front of dorsal; origin of dorsal on line with axil of pectoral, the distance between tip of snout and origin of dorsal 2.2 in length; longest spine 2.25 in head; middle ray of soft dorsal longest, 1.35 in head; origin of anal fin midway between base of caudal and origin of ventral, the middle rays of fin longest, 1.35 in head; second anal spine longest, 1.75 in head; origin of ventral below axil of pectoral, its tip reaching vent; pectoral equal to head; caudal emarginate, 1.1 in head.

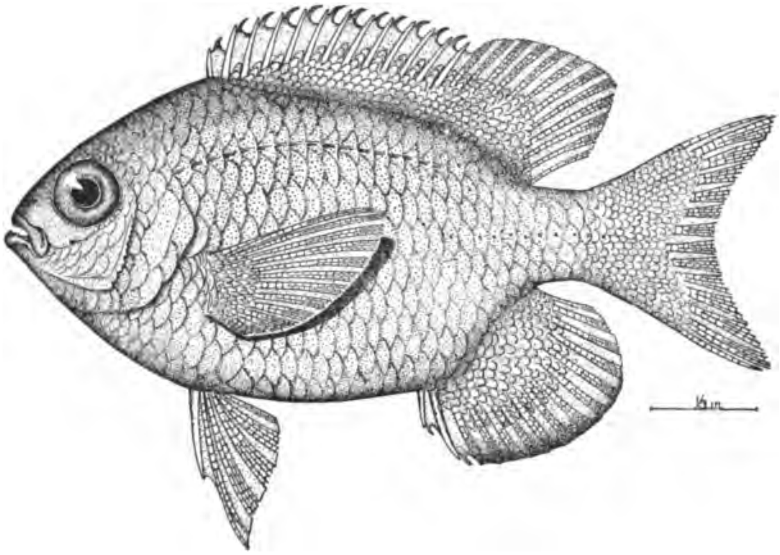

FIG. 16.—*Pomacentrus popei* Evermann & Seale, new species. Type.

Color in spirits, straw-yellow, no spots or dots on body or in axil of any fin; anal fin rather broadly margined with black; a narrow brownish margin to dorsal, indistinct on soft dorsal; otherwise fins all yellow, unmarked.

One fine specimen (no. 3470; length 2.45 in.). Type, no. 55903, U. S. National Museum, collected by Charles J. Pierson at Bacon, Sorsogon, P. I.

Named for our friend and associate, Mr. Thomas Edmund Burt Pope, scientific assistant, U. S. Bureau of Fisheries.

198. **Pomacentrus alexanderæ** Evermann & Seale, new species.

Head 3.45 in length; depth 2; eye 3 in head; interorbital 3.2; snout 4.5; dorsal XIII, 14; anal II, 14; scales 4-27-9.

Body compressed, elevated; depth of caudal peduncle 2 in head; anterior profile evenly rounded; mouth small; teeth in a single row in each jaw; maxillary ending on a line with anterior margin of orbit, its length slightly less than eye; mandible 3.1 in head; preorbital with some minute denticulations and one rather strong spine below anterior margin of pupil; greatest width of preorbital 2.5 in eye; preopercle distinctly denticulate; opercle with spine on posterior margin; gillrakers small, sharp-pointed, 13 on lower limb, the longest 2.5 in eye; 2 or 3 rows of scales on cheek; body and head fully scaled; lateral line with but 16 distinct tubules; about 20 series of scales in front of dorsal; origin of dorsal on a line with axil of pectoral, the spines gradually increasing in length, the last being longest, 1.5 in head, the anterior spine scarcely equal to eye; webs of spinous dorsal deeply incised; middle soft dorsal ray the longest, 1.25 in head; origin of anal below base of eleventh dorsal spine, its base 1.1 in head, its longest ray 1.3, the second spine 1.55; vertical fins with deep scaly sheath; ventral slightly nearer origin of anal fin than to tip of snout, its tip reaching vent; pectoral equal to length of head; caudal emarginate, the lobes pointed, length greater than head.

Color in spirits, dull yellowish, shading gradually into a soft brown on upper anterior portion of body and head; a large, deep, black spot covering entire base and axil of pectoral fin; some slight indications of very indistinct yellow longitudinal lines on side; spinous dorsal brownish, with dusky margin extending along upper edge of soft dorsal; soft dorsal becoming yellow on posterior half; anal yellow, the marginal third dusky; caudal yellow; ventrals with slight tint of dusky; pectoral yellow.

Seven specimens from Bacon (no. 3996 and 3905; length 3.25 to 3.5 in.). Type, no. 55919, U. S. National Museum, from Bacon, Sorsogon, P. I., length 3.5 in., collected by Mr. Charles J. Pierson. Of the cotypes one (Bureau of Fisheries, no. 3996) is no. 20005, Stanford University Museum; another is no. 4540, U. S. Bureau of Fisheries, and there is one each in the museum at Manila, Philadelphia Academy of Natural Sciences, U. S. National Museum, and Indiana University Museum.

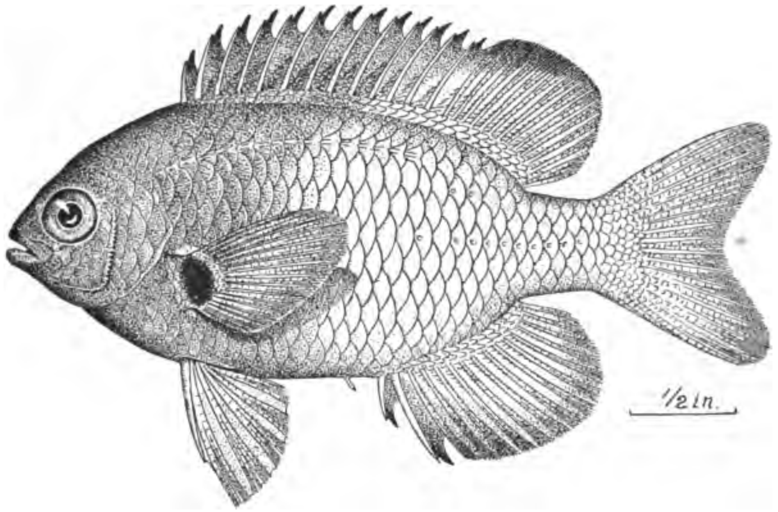

FIG. 17.—*Pomacentrus alexanderæ* Evermann & Seale, new species. Type.

Named for Miss Annie M. Alexander, of Oakland, California, in recognition of her interest and work in zoology.

199. **Pomacentrus philippinus** Evermann & Seale, new species.

Head 3.35 in length; depth 2; eye 3 in head; snout 4.1; interorbital 2.75; dorsal XIII, 14; anal II, 14; scales 4-26-9, -18 tubes.

Body oblong, compressed; depth of caudal peduncle 1.75 in head; anterior profile evenly rounded; jaws equal; maxillary scarcely equal to diameter of eye, its distal end under anterior margin of eye; mandible 3 in head; small teeth in jaws in single series, none on vomer or palatines; gillrakers slim, sharp-pointed, 12 on lower limb, the longest about equal to pupil; preorbital with 2 or 3 small denticulations, greatest width of preorbital 3 in eye; preopercle distinctly denticulate; opercle with a single spine on posterior border; body and head fully scaled, a single row on preorbital, 2 rows on cheek, a single row on lower limb of preopercle; very fine scales on top of head, about 23 series in front of dorsal; origin of dorsal above axil of pectoral; distance between origin of dorsal and tip of snout 1.25 in depth of fish; longest dorsal spine 1.75 in head, length of anterior spines 4.75; middle ray of dorsal longest, equal to head, its tip slightly produced; webs of spinous dorsal incised; origin of anal nearer base of ventral than base of caudal, the second spine the longest, 2.45 in head; middle ray of anal longest, about equal to head, the tip slightly produced; ventral below axil of pectoral, the first ray produced into a filament reaching posterior to vent; pectoral slightly greater than head, its tip on a line with vent; caudal greater than head, the lobes produced.

Color in spirits, purplish, slightly lighter on thorax; caudal yellow, fading into purplish on caudal peduncle; lower half of soft dorsal and upper half of anal yellow, the other portion of these fins dusky, the line of demarcation between the 2 colors abrupt; ventrals black; pectoral dusky, a black spot on upper two-thirds of pectoral base and on axil of fin.

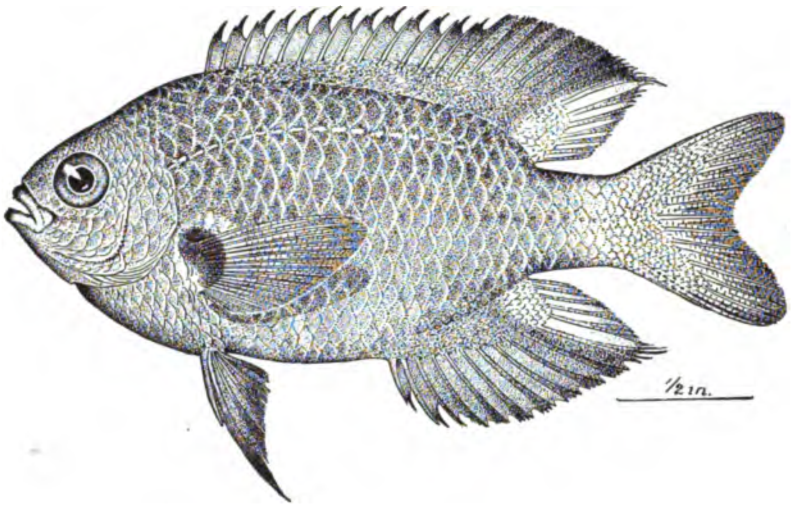

FIG. 18.—*Pomacentrus philippinus* Evermann & Seale, new species. Type.

Two specimens from Bacon (no. 4207 and 4028; length 2.5 and 2.75 in.). Type, no. 55901, U. S. National Museum, from Bacon, Sorsogon, P. I., collected by Charles J. Pierson, and cotype, no. 20009, Stanford University Museum.

200. **Abudefduf xanthurus** (Bleeker).

Eleven specimens from Bacon (no. 3461 to 3469, 3906, and 3854; length 3.5 to 4.5 in.).

Glyphidodon xanthurus Bleeker, Nat. Tijds. Ned. Ind., v, 1853, 345, **Amboyna**; Günther, Cat., iv, 47 (Ceram; **Amboyna**).
Paraglyphidodon xanthurus Bleeker, Atlas, ix, pl. ccccv, fig. 3.

201. **Abudefduf bankieri** (Richardson).

Five specimens from Bacon (no. 3891, 4205, and 4206; length 1.75 to 2.5 in.).

Glyphisodon bankieri Richardson, Ichth. China, 253, 1846, **Hongkong**; Günther, Cat., iv, 54 (China).
Parapomacentrus bankieri Bleeker, Atlas, ix, pl. ccccviii, fig. 8.

202. **Abudefduf zonatus** (Cuvier & Valenciennes).

Two specimens from Bacon (no. 4208 and 3680; length 2 and 2.5 in.).

Glyphisodon zonatus Cuvier & Valenciennes, Hist. Nat. Poiss., v, 361 (483), 1830, **New Guinea.**
Glyphidodontops zonatus, Bleeker, Atlas, ix, pl. ccccvii, fig. 3.
Glyphidodon brownriggii Günther, Fische der Südsee, 232, pl. 127, fig. a and c; in part.

203. **Abudefduf cyaneus** (Quoy & Gaimard).

Four specimens from Bacon (no. 3863 and 4212; length 1.2 to 2.25 in.). Dorsal xiii, 12; preorbital and preopercle entire; depth 2.2 without caudal; head 3.35. Color in spirits deep blue; pectoral, soft dorsal, caudal, ventral, and anal yellowish; a small indistinct deeper blue spot at origin of lateral line; no spot in axil of pectoral or on soft dorsal; no stripes on head.

One specimen (no. 4212) is uniform blue without yellowish on fins. This specimen is slightly less in depth than the others, the ventral fins being also a little darker in color.

Glyphisodon cyaneus Quoy & Gaimard, Voy. Uranie, Zool., 392, pl. 64, fig. 3, 1824; no locality.

204. **Abudefduf antjerius** (Kuhl & Van Hasselt).

Three specimens from Bacon (no. 3470, 3471, and 4210; length 1.4 to 2.1 in.).

Glyphisodon antjerius Kuhl & Van Hasselt in Cuvier & Valenciennes, Hist. Nat. Poiss., v, 360 (481), **Antjer**; Günther, Cat., IV, 50 (Amboyna; Borneo).

205. **Abudefduf glaucus** (Cuvier & Valenciennes).

Three specimens from Bacon (no. 4202 to 4204; length 2 to 2.5 in.).

Glyphisodon glaucus Cuvier & Valenciennes, Hist. Nat. Poiss., v, 355 (475), 1830, **Guam**.

206. **Abudefduf curaçao** (Bloch).

Seven specimens from Bacon (no. 4020, 4021, 3925, 3926, 3779, 3877, and 3879; length 2.75 to 4 in.). These specimens differ from the descriptions and figure in having the lower posterior part of anal dusky and a dusky wash on upper and lower margin of caudal, but not as in *A. cœlestinus*, with which we have compared it.

Chætodon curaçao Bloch, Ichth., VI, 79, pl. CCXII, fig. 1, 1797, **Curaçao**.
Glyphisodon trifasciatus; Günther, Cat., IV, 42 (Amboyna; Ceram).

207. **Abudefduf septemfasciatus** (Cuvier & Valenciennes).

One specimen from Bulan (no. 3879; length 4.95 in.).

Glyphisodon septemfasciatus Cuvier & Valenciennes, Hist. Nat. Poiss., v, 346 (463), 1830, **Ile de France**; Günther, Cat., IV, 40, 1862 (China; Philippine Islands; Ceylon).

208. **Abudefduf unimaculatus** (Cuvier & Valenciennes).

Two specimens from Bacon (no. 4209 and 4210; length 2 and 2.75 in.). Head 3.4 in total length; depth 2.1; dorsal xiii, 13; anal ii, 12. Color in spirits purplish, a black spot in axil of soft dorsal.

Glyphisodon unimaculatus Cuvier & Valenciennes, Hist. Nat. Poiss., v, 358 (478), **Timor**.
Glyphidodon unimaculatus, Günther, Cat., IV, 51 (Borneo).
Glyphidodontops unimaculatus, Bleeker, Atlas, IX, pl. CCCCVII, fig. 5 (not 6, as labeled).

Family LABRIDÆ.

209. **Cheilinus fasciatus** (Bloch).

Three specimens from Bacon (no. 3971 to 3973; length 4.2 in.).

Sparus faciatus Bloch, Ichth., VIII, 15, pl. CCLVII, 1797, **Japan**.
Cheilinus fasciatus, Günther, Cat., IV, 129 (Amboyna); Bleeker, Atlas, I, 67, pl. XXVI, fig. 2.

210. **Cheilinus chlorurus** (Bloch).

Five specimens from Bacon (no. 3503, 3504 and 3872 to 3874; length 4 to 7.75 in.).

Sparus chlorurus Bloch, Ichth., VIII, 21, pl. CCLX, 1797, "**Japan and St. Domingue.**"
Cheilinus chlorurus, Günther, Cat., IV, 128 (Amboyna; Ceylon; Ceram; Aneityum); Bleeker, Atlas, I, 65, pl. XXVII, fig. 3.

211. **Stethojulis zatima** Jordan & Seale.

One specimen from Bacon (no. 4214: length 1.75 in.) and one without local label (no. 4191; length 1.5 in.).

Stethojulis zatima Jordan & Seale, Proc. U. S. Nat. Mus., XXVIII, 788, 1905, **Negros, Philippine Islands**.

212. **Stethojulis phekadopleura** (Bleeker).

One specimen from Bacon (no. 4215; length 2 in.).

Julis phekadopleura Bleeker, Ichth. fauna Bali, 8, Verh. Bat. Gen., XXII, 1849, **Bali**.
Stethojulis phekadopleura Bleeker, Atlas, I, 134, pl. XLIII, fig. 5; Günther, Cat., IV, 143.

213. **Cheilio inermis** (Forskål).

Fourteen specimens from Bacon (no. 3520, 3584 to 3586, 3413 to 3415, 3652, 3699, 3945, 3610, 3611, 3720 and 3836; length 3.2 to 13.5 in.).

Labrus inermis Forskål, Descr. Anim., 34, 1775, **Red Sea**.
Cheilio inermis, Jordan & Evermann, Bull. U. S. Fish Comm., XXIII, pt. 1, 1903 (1905), 314, pl. XXXIII (Honolulu; Hilo).

214. **Lepidaplois mesothorax** (Bloch & Schneider).

One specimen from Bacon (no. 3920; length 5.5 in.).

Labrus mesothorax Bloch & Schneider, Syst. Ichth., 254, 1801, **India.**
Cossyphus mesothorax, Günther, Cat., IV, 103 (Ceram; Amboyna); Bleeker, Atlas, I, 159, pl. XXXVIII, fig. 4 (misprinted *mesotyorax* in text).

215. **Labroides paradiseus** Bleeker.

Two specimens from Bacon (no. 3843; length 2 and 2.75 in.).

Labroides paradiseus Bleeker, Nat. Tijds. Ned. Ind., II, 249, **Banda**; Atlas, I, pl. XLIV, fig. 2.

216. **Thalassoma lunaris** (Linnæus).

One specimen from Bacon (no. 3995; length 4.75 in.). A small patch of scales on upper part of opercle; anal with 2 spines.

Labrus lunaris Linnæus, Syst. Nat., ed. X, 283, 1758, **India.**
Julis lunaris Bleeker, Atlas, I, 90, pl. XXXIII, fig. 5.

217. **Novaculichthys macrolepidotus** (Bloch).

One specimen from Bacon (no. 3918; length 4 in.). This specimen seems to have more dusky on the sides than any others so far examined, there being a wide, more or less interrupted, black band from head to caudal.

Labrus macrolepidotus Bloch, Ichth., VIII, 109, pl. CCLXXXIV, 1797, **East Indies.**
Novaculichthys macrolepidotus, Bleeker, Atlas, I, 144, pl. XXXI, fig. 6.
Novacula macrolepidota, Günther, Cat., IV, 174 (Mozambique).

218. **Halichœres scapularis** (Bennett).

Seven specimens from Bacon (no. 3840, 3963 to 3965, and 4147 to 4149; length 2 to 6.25 in.). These form a perfect series in size and intergradation of color from the figure and descriptions given by Bleeker and Day to the young as described by Jordan and Seale. There can be no doubt that *Guntheria cœruleovittata, Platyglossus scapularis,* and *H. cymatogrammus* are one and the same species, the difference in color markings being due to age.

Julis scapularis Bennett, Proc. Comm. Zool. Soc. Lond. 1831, 167, **Mauritius.**
Guntheria cœruleovittata Bleeker, Atlas, I, pl. XXXII, fig. 2.
Platyglossus scapularis, Day, Fishes India, 400, pl. LXXXV, fig. 4.
Halichœres cymatogrammus Jordan & Seale, Proc. U. S. Nat. Mus., XXVIII, 1905 (July 3), 786, fig. 8, **Negros, Philippine Islands.** (Young.)

219. **Halichœres purpurescens** (Bloch & Schneider).

One specimen from Bacon (no. 4014; length 5 in.).

Labrus purpurescens Bloch & Schneider, Syst. Ichth., 262, 1801.
Platyglossus purpurascens, Günther, Cat., IV, 158; Bleeker, Atlas, I, 108, pl. XLV, fig. 1.

220. **Halichœres nigrescens** (Bloch & Schneider).

Two specimens from Bulan (no. 4075 and 4076; length 5.2 and 6.5 in.).

Labrus nigrescens Bloch & Schneider, Syst. Ichth., 263, 1801.
Halichœres nigrescens Bleeker, Atlas, I, 118, pl. XXXVII, fig. 4.

221. **Halichœres miniatus** (Kuhl & Van Hasselt.)

Seven specimens from Bacon (no. 4003 and 4213; length 1 to 3 in.).

Julis miniatus Kuhl & Van Hasselt in Cuvier & Valenciennes, Hist. Nat. Poiss., XIII, 337 (460), **Java**; Günther, Cat., IV, 150.
Halichœres miniatus, Bleeker, Atlas, I, 114, pl. XLI, fig. 5.

222. **Halichœres guttatus** (Bloch).

Five specimens from Bacon (no. 3753 and 4000; length 2.5 to 2.75 in.).

Labrus guttatus Bloch, Ichth., pl. CCLXXXVIII, fig. 2, 1797, **New Holland.**
Labrus argus Bloch & Schneider, Syst. Ichth., 263, 1801.
Platyglossus guttatus, Günther, Cat., IV, 155 (Sumatra; Ceram; Chusan).
Halichœres guttatus, Bleeker, Atlas, I, 124, pl. XXXV, fig. 1.

223. **Halichœres leparensis** (Bleeker). *Masangui.*

Twelve specimens from Bacon (no. 3770 and 4001; length 1.25 to 2 in.) and one from San Fabian (no. 3835; length 1.25 in.).

Julis leparensis Bleeker, Nat. Tijds. Ned. Ind., III, 1852, 730, **Banka.**
Halichœres leparensis Bleeker, Atlas, I, 119, pl. XLII, fig. 5.
Platyglossus leparensis, Günther, Cat., IV, 156.

224. **Halichœres pœcilus** (Lay & Bennett).

Seven specimens from Bacon (no. 3980; length 1.5 to 3.5 in.).

Julis pœcila Lay & Bennett, Zool. Beech. Voy., Blossom, 66, pl. 19, fig. 1, **Loo-Choo Islands.**
Halichœres pœcila, Bleeker, Atlas, I, 115, pl. XXXIX, fig. 4.
Platyglossus pœcilus, Günther, Cat., IV, 152.
Halichœres annulatus Fowler, Journ. Ac. Nat. Sci. Phila., 2d ser., XII, 535, pl. XX, upper fig., June 10, 1904, **Sumatra.**

Family PSEUDOCHROMIDÆ.

225. **Labracinus trispilos** (Bleeker).

Two specimens from Bacon (no. 4216; length 1.2 and 1.25 in.).

Cichlops trispilos Bleeker, Nat. Tijds. Ned. Ind., IX, 1855, 110, **Halmaheira, Batjan**; Bleeker, Atlas, IX, pl. CCCXC, fig. 2.

226. **Labracinus melanotænia** (Bleeker).

One specimen from Bulan (no. 3933; length 5.5 in.).

Cichlops melanotænia Bleeker, Nat. Tijds. Ned. Ind., III, 1852, 765, **Macassar, Celebes**; Günther, Cat., II, 259.
Pseudochromis melanotænia, Bleeker Atlas, IX, pl. CCCXC, fig. 5.

Family SCARICHTHYIDÆ.

227. **Chœrops anchorago** (Bloch). *Mulmul.*

Nine specimens from Bacon (no. 3552 to 3554, 3536, 3691, 3692, 4138, 4139, and 4066; length 5 to 8.5 in.), and one from Jolo (no. 3239; length 6 in.).

Sparus anchorago Bloch, Ichth., VIII, 85, pl. CCLXXVI, 1797.
Chœrops anchorago, Günther, Cat., IV, 95 (Amboyna).

228. **Chœrops auritum** (Kuhl & Van Hasselt). *Duldul.*

One specimen from Bacon (no. 3819; length 3 in.), and 2 (no. 4067 and 4070; length 9 in.), without definite locality.

The degree of development of the canine teeth varies greatly in this as in related species.

Scarus auritus Kuhl & Van Hasselt in Cuvier & Valenciennes, Hist. Nat. Poiss., XIV, 161 (218), 1839, **Java.**
Scarichthys auritus, Günther, Cat., IV, 213 (Amboyna; Hongkong; Aneityum); Bleeker, Atlas, I, 15, pl. I, fig. 3.

229. **Scarichthys cœruleopunctatus** (Rüppell). *Duldul.*

One specimen from Jolo (no. 4110), 2 from Bulan (no. 3241 and 3242; length 5.5 and 6.5 in.), and 3 from Bacon (no. 3737 and 3799; length 6 to 10.2 in.).

This species may be distinguished from *S. auritus* by the strong development of canine teeth.

Scarus (*Calliodon*) *cœruleo-punctatus* Rüppell, Neue Wirb., Fische, 24, pl. 7, fig. 3, **Djedda**; Günther, Cat., IV, 213; Bleeker, Atlas, I, 16, pl. I, fig. 2.

230. **Calotomus genistriatus** (Cuvier & Valenciennes). *Ogus; Palit.*

One specimen from Zamboanga (no. 3773; length 8.75 in.), and one from Jolo (no. 4055; length 9.75 in.).

Callyodon genistriatus Cuvier & Valenciennes, Hist. Nat. Poiss., XIV, 218 (293), 1839, **no locality given**; Günther, Cat., IV, 215; Bleeker, Atlas, I, 13, pl. I, fig. 1.

231. **Callyodon quoyi** (Cuvier & Valenciennes).

One specimen from Bacon (no. 3234; length 7.5 in.).

Scarus quoyi Cuvier & Valenciennes, Hist. Nat. Poiss., xiv, 203 (273), 1839, **New Ireland (New Mecklenburg).**
Pseudoscarus quoyi, Bleeker, Atlas, i, 29, pl. vi, fig. 3 (Ternate); Günther, Cat., iv, 239.

232. **Callyodon lacerta** (Cuvier & Valenciennes).

Three specimens from Bulan (no. 3938, 3939, and 3240; length 4.75 to 6.2 in.), and one from Bacon (no. 4126).

Scarus lacerta Cuvier & Valenciennes, Hist. Nat. Poiss., xiv, 161 (217), 1839, **Pondicherry.**
Pseudoscarus æruginosus Bleeker, Atlas, i, 40, pl. xvii, fig. 2, 1862; Günther, Cat., iv, 229.

233. **Callyodon oktodon** (Bleeker). *Mulmul.*

One specimen from Zamboanga (no. 3715; length 10.75 in.).

Pseudoscarus oktodon Bleeker, Versl. Kon. Akad. Wet., xii, 1861, 235, **Buton**; Bleeker, Atlas, i, 33, pl. xiii, fig. 2, 1862.
Pseudoscarus octodon, Günther, Cat., iv, 234.

234. **Callyodon balinensis** (Bleeker).

One specimen from Bacon (no. 3735; length 8.25 in.).

Scarus balinensis Bleeker, Ichth. Fauna Bali, 8, Verh. Bat. Gen., xxii, 1849, **Bali.**
Pseudoscarus balinensis Bleeker, Atlas, i, 39, pl. xvi, fig. 3, 1862; Günther, Cat., iv, 228.

Family CHÆTODONTIDÆ.

235. **Chætodon selene** Bleeker.

One specimen from Bulan (no. 4342; length 5.2 in.). This specimen shows a wide dusky longitudinal stripe along the median line of side from caudal, fading out near head.

Chætodon selene Bleeker, Nat. Tijds. Ned. Ind., v, 76, 1853, **Solor**; Günther, Cat., ii, 30 (Amboyna).
Tetragonoptrus (*Chætodontops*) *selene* Bleeker, Atlas, ix, pl. ccclxxvii, fig. 5.

236. **Chætodon auriga** Forskål.

One specimen from Bacon (no. 3694; length 4.75 in.).

Chætodon auriga Forskål, Descr. Anim., 60, 1775, **Red Sea**; Günther, Cat., ii, 7 (Red Sea).
Tetragonoptrus (*Linophora*) *auriga*, Bleeker, Atlas, ix, pl. ccclxxiii, fig. 4.

237. **Chætodon vagabundus** Linnæus.

One specimen from Bacon (no. 3387; length 5.35 in.).

Chætodon vagabundus Linnæus, Syst. Nat., ed. x, 276, 1758, **Indies**; Günther, Cat., ii, 25 (Mauritius; Amboyna); Fowler, Fishes of Sumatra, 544, 1904.
Tetragonoptrus (*Linophora*) *vagabundus*, Bleeker, Atlas, ix, 48, pl. ccclxxviii, fig. 1 (Sumatra, etc.).

238. **Chætodon falcula** Bloch.

Two specimens from Bacon (no. 3369 and 3370; length 5.1 and 5.25 in.).

Chætodon falcula Bloch, Ichth., xii, 100, pl. ccccxxvi, fig. 2, 1797, **Coromandel**; Günther, Cat., ii, 17 (Batoe); Günther, Fische der Südsee, pl. 27, fig. c.
Tetragonoptrus (*Oxychætodon*) *falcula*, Bleeker, Atlas, ix, 52, pl. ccclxxiii, fig. 1.

239. **Chætodon octofasciatus** Bloch.

Two specimens from Bacon (no. 3894 and 3917; length 2.75 and 3.1 in.). These specimens show a dusky spot below the lateral line between the fourth and fifth black bands.

Chætodon octofasciatus Bloch, Ichth., vi, 85, pl. ccxv, fig. 1, 1797, **East Indies**; Günther, Cat., ii, 17 (Singapore).
Tetragonoptrus (*Tetragonoptrus*) *octofasciatus*, Bleeker, Atlas, ix, 38, pl. ccclxxvi, fig. 3.

240. **Chætodon unimaculatus** Bloch.

One specimen from Bacon (no. 3342; length 4 in.). This specimen has a dusky wedge-shaped area extending down from the black spot.

Chætodon unimaculatus Bloch, Ichth., pl. CCI, fig. 1, East Indies; Günther, Cat., II, 11.
Tetragonoptrus (*Lepidochætodon*) *unimaculatus*, Bleeker, Atlas, IX, 45, pl. CCCLXXV, fig. 5.

241. **Taurichthys varius** Cuvier & Valenciennes.

One large specimen from Bacon (no. 3336; length 5.56 in.).

Taurichthys varius Cuvier & Valenciennes, Hist. Nat. Poiss., VII, 111 (148), pl. 181, 1831, no locality given.
Heniochus varius, Günther Cat., II, 41 (Molucca Sea; Amboyna).

242. **Heniochus acuminatus** (Linnæus). *Pampanon.*

One specimen from Bacon (no. 3437; length 4.25 in.), and 3 young from San Fabian (no. 3771; length 2 in.).

Chætodon acuminatus Linnæus, Syst. Nat., ed. X, 272, 1758, Indies.
Chætodon macrolepidotus Linnæus, Syst. Nat., ed. X, 274, 1758; after Artedi.
Heniochus macrolepidotus, Günther, Cat., II, 39 (Ceylon; Amboyna; Port Essington; Australia).
Taurichthys macrolepidotus, Bleeker, Atlas, IX, 29, pl. CCCLXVII, fig. 1. (Misprinted *microlepidatus* on plate.)
Heniochus acuminatus, Jordan & Evermann, Bull. U. S. Fish Comm., XXIII, pt. 1, 1903 (1905), 376, pl. LV (Honolulu).

Family PLATACIDÆ.

243. **Platax orbicularis** (Forskål). *Kiting.*

Two fine adults from Jolo (no. 4158 and 4159; length 6 and 6.5 in.). Anterior dorsal and anal rays greatly produced, those of dorsal exceeding total length of fish; ventrals very long, equaling length of fish to base of caudal.

Chætodon orbicularis Forskål, Descr. Anim., 59, 1779, Red Sea.
Chætodon vespertilio Bloch, Ichth., VI, 49, pl. CXCIX, fig. 2, 1797.
Platax vespertilio, Day, Fishes India, 236, pl. LI, fig. 5; Bleeker, Atlas, IX, 74, pl. CCCLXXIX, fig. 1, and pl. CCCLXXX, figs. 2 and 3.
Platax orbicularis, Günther, Cat., II, 490 (Port Essington).

Family EPHIPPIDÆ.

244. **Ephippus argus** (Gmelin). *Pingao* (young); *Saramolleta.*

Three specimens from Bacon (no. 4087 to 4089; length 5.5 to 6.75 in.), and 7 young from San Fabian (no. 3988; length 2 to 2.55 in.).

Chætodon argus Gmelin, Syst. Nat., 1248, 1788, Indies.
Scatophagus argus, Günther, Cat., II, 58 many localities; Day, Fishes India, 114, pl. XXIX, fig. 3.

Family ACANTHURIDÆ.

245. **Hepatus celebicus** (Bleeker).

One specimen from Bulan (no. 4122; length 6.75 in.). White ring obsolete.

Acanthurus celebicus Bleeker, Nat. Tijds. Ned. Ind., III, 1852, 761, Celebes; Günther, Cat., III, 339.

246. **Ctenochætus striatus** (Quoy & Gaimard). *Saliao.*

Two specimens from Zamboanga (no. 4120 and 4121; length 8.2 and 9.5 in.).

Acanthurus striatus Quoy & Gaimard, Voy. Uranie, Zool., 373, pl. 63, fig. 3, 1824, Guam; Günther, Cat., III, 334.
Ctenochætus striatus, Jordan & Evermann, Bull. U. S. Fish Comm., XXIII, pt. 1, 1903 (1905), 398 (Hilo; Honolulu; Kailua).

247. **Acanthurus unicornis** (Forskål).

One specimen (young) from San Fabian (no. 3960; length 2.5 in.).

Chætodon unicornis Forskål, Descr. Anim., 63, 1775, Djidda.
Acanthurus unicornis, Jordan & Evermann, Bull. U. S. Fish Comm., XXIII, pt. 1, 1903 (1905), 402 (Honolulu; Hilo; Puako Bay, Hawaii).

Family SIGANIDÆ.

248. **Siganus javus** (Linnæus).

Two specimens from Bulan (no. 4092 and 4093; length 9 and 10 in.). Head 4.1 in length; depth 2.18; snout 2.1 in head; eye 3.35. Dorsal XIII, 10; anal VII, 9.

Teuthis javus Linnæus, Syst. Nat., ed. XII, 507, 1766; Day, Fishes India, 165, pl. XXXIX, fig. 5; Günther, Cat., III, 315 (Ceylon; Singapore; Amboyna; Hobson Bay).
Amphacanthus javus, Cuvier & Valenciennes, Hist. Nat. Poiss., X, 86 (118), (Pondicherry).

249. **Siganus fuscescens** (Houttuyn). *Palit.*

Apparently a very abundant species in the Philippines. The present collection contains 747 specimens from Bacon (no. 3382, 3622, 3623, 3923, 3924, 3440, 3500, 3501, 3502, 3513, 3851, 4006, 4007, 4143, 4144; length 1.5 to 8.5 in.), 2 from Jolo (no. 3518 and 3639), and 1 from San Fabian (no. 3864).

These have been carefully compared with specimens from Japan, Cavite, and Panay. They agree perfectly, even to the bars on the caudal.

Centrogaster fuscescens Houttuyn, Verh. Holl. Maat. Weet. Haarlem, XX, 1782, 333.
Amphacanthus fuscescens ,Richardson, Ichth. China, 243, 1846.
Teuthis fuscescens, Günther, Cat., III, 321 (coast of Nagasaki).

250. **Siganus virgatus** (Cuvier & Valenciennes).

One specimen from Bacon (no. 3233; length 7.5 in.). Readily known by the bluish transverse lines on snout and interorbital and the oblique dark lines downward and forward from dorsal.

Amphacanthus virgatus Cuvier & Valenciennes, Hist. Nat. Poiss., X, 97 (133), 1835, Java.
Teuthis virgata, Günther, Cat., III, 323 (Philippines; China); Day, Fishes India, 166, pl. XL, fig. 3 (Andamans).

251. **Siganus vermiculatus** (Kuhl & Van Hasselt). *Pugut; Alama.*

Seven specimens from Zamboanga (no. 3251 to 3257; length 3.5 to 6.75 in.), 4 from Bacon (no. 3303 to 3306; length 3 to 4 in.), 3 from Philippines (no local label, no. 3800 to 3802; length 3 in.), and one very large specimen from San Fabian (no. 4037; length 11 in.).

Amphacanthus vermiculatus Kuhl & Van Hasselt in Cuvier & Valenciennes, Hist. Nat. Poiss., X, 92 (126), 1835, New Guinea.
Teuthis vermiculata, Günther, Cat., III, 317 (Philippines; Amboyna); Day, Fishes India, 166, pl. XL, fig. 1

252. **Siganus lineatus** (Cuvier & Valenciennes). *Samaral; Mororosa.*

Two from Bulan (no. 4056 and 4057; length 9.75 and 10.5 in.), and one from Bacon (no. 4039; length 10.2 in.).

Amphacanthus lineatus Cuvier & Valenciennes, Hist. Nat. Poiss., X, 95 (130), pl. 286, 1835, Vanicolo and New Guinea.
Teuthis lineata, Günther, Cat., III, 322.

253. **Lo unimaculatus** Evermann & Seale, new species.

Head 3.3 in length to base of caudal; depth 2.5; eye 4 in head; snout 1.9; opercle with a number of low thin vertical ridges; preopercle with somewhat similar oblique lines; lower edge of preopercle finely dentate; scales cycloid and very minute on body, the head nearly naked, having only a few scattered nonimbricated scales below eye and along side of snout; interorbital 3.75; pectoral 1.45; ventral scarcely shorter than pectoral; dorsal XIII, 10; anal VII, 9; ventral I, 3, I.

Body greatly compressed, elongate, the ventral and dorsal outlines nearly parallel from nuchal crest to base of twelfth dorsal spine; snout much produced, tubular, the maxillary 1.3 in eye; interorbital space but slightly convex; dorsal profile rising abruptly from behind the eye in a thin trenchant ridge; teeth in a single row, uniform in size, incisor-like, brown-tipped in the upper jaw, smaller and plain white in color in the lower, about

12 on each side in each jaw; origin of dorsal in vertical above base of pectoral, the first spine 1.6 in snout, the longest spine (the seventh) about equal to snout and half diameter of eye, the last spine equal to snout; origin of anal under base of seventh dorsal spine; first anal spine slightly longer than first spine of dorsal, the fourth spine slightly greater than snout; soft dorsal and soft anal pointed, the middle rays longest, about equal in the 2 fins and equaling the snout; caudal moderately forked, the lobes equal to snout and half eye; ventral not reaching origin of anal.

Color in alcohol, mottled brownish; snout, head and breast back to origin of dorsal and ventral fins rich brownish black, extending on side in a broad curve to middle of pectoral; interorbital space and side of head below eye paler; first dorsal spine black, the others yellowish white; first ray of pectoral black; rays of fin whitish with some indistinct black blotches; skin of ventral spines blackish, rays of the fin white; soft dorsal and entire anal yellowish white, the spines of the latter with dark edges; caudal dusky along edges, otherwise yellowish white; a large round brownish black spot one-half larger than eye on lateral line under base of last 3 dorsal spines and first dorsal ray.

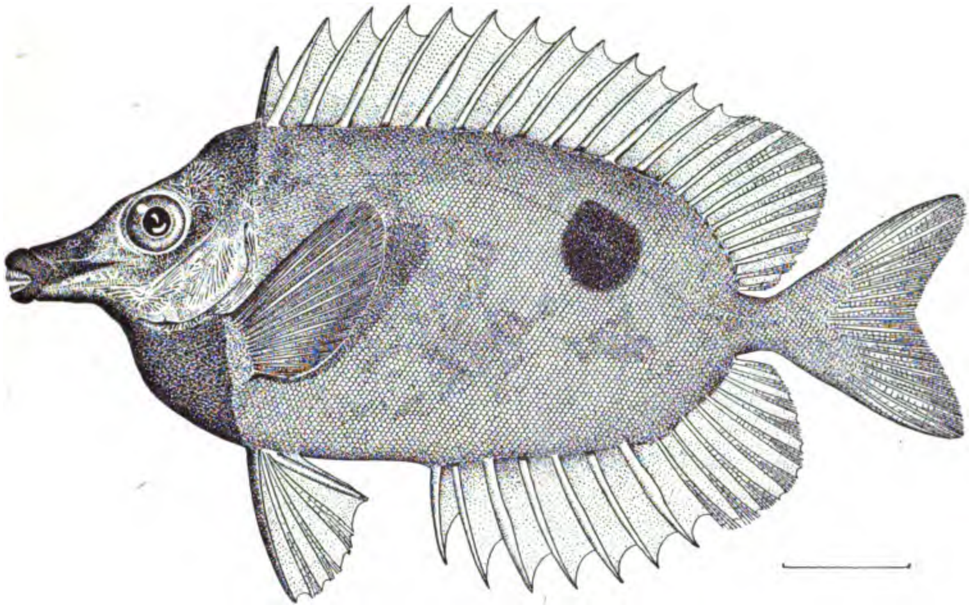

FIG. 19.—*Lo unimaculatus* Evermann & Seale, new species. Type.

This species is related to *Lo vulpinis* (Schlegel & Müller), from which it differs in the more slender body and in the presence of the black lateral spot.

Only one specimen obtained, the type, no. 55915, U. S. National Museum (original no. 3538), 7.5 inches long, collected by Mr. Charles J. Pierson, at Bacon, Sorsogon, P. I.

Family BALISTIDÆ.

254. **Balistes niger** Mungo Park.

One specimen from Bacon (no. 3603; length 5.5 in.).

Balistes niger Mungo Park, Trans. Linn. Soc. Lond., III, 1797, 37, Sumatra; Günther, Cat., VIII, 218; Bleeker, Atlas, V, pl. CCXVI, fig. 1.

255. **Balistes flavimarginatus** Rüppell. *Pakol.*

One very large specimen (no. 4154; length 15 in.) from Bacon. Head 3 in length; depth 1.8; eye 5 in head; snout 1.2; interorbital 2.8; first dorsal spine 1.8; depth of caudal peduncle 3.5, its greatest width 5;

longest dorsal ray 1.75; longest anal ray 1.5; length of pectoral 2. Teeth very strong, the front ones conic; dermal plates strong and rough, 29 from gill-opening to base of caudal; preocular groove distinct.

Balistes flavimarginatus Rüppell, Atlas, Fische, 33, 1828, **Red Sea**; Günther, Cat., VIII, 223 (Red Sea; Amboyna).
Balistes (*Pseudobalistes*) *flavimarginatus*, Bleeker, Atlas, V, 113, pl. CCXXIV, fig. 3.

256. Balistapus undulatus (Mungo Park).

Nine specimens from Bacon (no. 3374, 3375, 3438, 3439, 3604, 4058 to 4060, and 4123; length 4.75 to 6.5 in.).

Balistes undulatus Mungo Park, Trans. Linn. Soc. Lond., III, 1797, 37, **Sumatra**; Günther, Cat., VIII, 226 (Red Sea; Zanzibar; Moluccas; Sumatra; Amboyna; Ceram; Zebu, Philippines; China; Japan).
Balistes (*Balistapus*) *lineatus* Bleeker, Atlas, V, 118, pl. CCXXIX, fig. 2.

257. Balistapus aculeatus (Linnæus). *Pugut.*

Nine specimens from Bacon (no. 3307, 3308, 3388, 3389, 3433 to 3435, 4118 and 4119; length 3.5 to 6.5 in.), and 2 from Zamboanga (no. 3364 and 3373).

Balistes aculeatus Linnæus, Syst. Nat., ed. X, 328, **India**; Günther, Cat., VIII, 223 (Ile de France; Island of Johanna; Zanzibar; Moluccas; Amboyna; China Seas; Fiji; Micronesia; Seychelles; Mauritius).
Balistapus aculeatus, Jordan & Evermann, Bull. U. S. Fish Comm., XXIII, 1903 (1905), 414, pl. LXII.

Family MONACANTHIDÆ.

258. Monacanthus chinensis (Bloch).

Three specimens from Bulan (no. 3259, 3260, and 4140; length 5 to 6.5 in.).

Balistes chinensis Bloch, Ichth., V, 24, pl. CLII, fig. 1, 1797, **Brazil and China**.
Monacanthus chinensis, Günther, Cat., VIII, 236 (North China; Pinang; Singapore; Shanghai); Bleeker, Atlas, V, 125, pl. CCXXII, fig. 2.

259. Monacanthus macrurus Bleeker. *Bungaong.*

One fine specimen from Jolo (no. 3693; length 7.5 in.), and one from Bacon (no. 3676; length 5.55 in.). These specimens show traces of dark bands at base of anal.

Monacanthus macrurus Bleeker, Nat. Tijds. Ned. Ind., XII, 226, 1857, **Nias**; Günther, Cat., VIII, 247, 1870.
Pseudomonacanthus macrurus Bleeker, Atlas, V, 134, pl. CCXXVIII, fig. 2.

260. Osbeckia scripta (Osbeck). *Samarang.*

Three specimens from Jolo (no. 3313 to 3315; length 4.5 to 8.2 in.). Color in spirits, yellowish with brown spots and reticulations; caudal 2.5 in length.

These specimens differ from typical examples of *O. scripta* in having the dorsal spine very short, its length being less than diameter of eye. They may represent an undescribed species, the describing of which we defer until additional material can be examined.

Balistes scriptus Osbeck, Reise nack Ostindien und China, 1, 144, 1765, **China Seas**.
Balistes monoceros scriptus, Gmelin, Syst. Nat., 1463, 1788; after Osbeck.
Monacanthus scriptus, Günther, Cat., VIII, 252.
Osbeckia scripta, Jordan & Evermann, Bull. U. S. Fish Comm., XXIII, 1903 (1905), 422, fig. 184 (Honolulu).

Family TETRAODONTIDÆ.

261. Lagocephalus hypselogeneion (Bleeker).

Three specimens from Bulan (no. 4023 to 4025; length 3.5 to 3.75 in.).

These examples have the fold of skin on lower posterior portion of side and tail well developed; caudal lunate and banded with numerous fine vertical lines; cheek with 5 subvertical bars of brown; upper half of body with numerous whitish spots. These seem to resemble Day's figure in every respect.

Tetraodon hypselogeneion Bleeker, Nat. Tijds. Ned. Ind., III, 300, 1852, **Amboyna, Wahai**.
Tetrodon hypselogenion, Günther, Cat., VIII, 277; Day, Fishes India, 702, pl. CLXXXIII, fig. 5.

262. Canthigaster bennetti (Bleeker).

Four specimens from Bacon (no. 3749; length 1.25 to 1.75 in.).

Tropidichthys bennetti Bleeker, Nat. Tijds. Ned. Ind., VI, 504, **Amboyna.**
Tetrodon bennetti, Günther, Cat., VIII, 301.
Canthogaster ocellatus Bleeker, Atlas, v, 80.
Psilonotus ocellatus, Bleeker, Atlas, v, pl. CCXIV, fig. 5.

263. Canthigaster compressus (Procé).

Two specimens from Philippines (no local label, no. 4018; length 2.2 and 2.75 in.).

Tetrodon compressus Procé, Bull. Soc. Philom. 1822, 130, **Manila.**
Tetrodon striolatus, Günther, Cat., VIII, 304.
Canthogaster striolatus, Bleeker, Atlas, v, 82.
Psilonotus striolatus, Bleeker, Atlas, v, pl. CCXIII, fig. 6.

264. Spheroides lunaris (Bloch & Schneider). *Botete.*

One specimen from San Fabian (no. 4033; length 3.25 in.).

Tetrodon lunaris Bloch & Schneider, Syst. Ichth., 505, 1801, **Malabar**; Günther, Cat., VIII, 274 (Philippines and many other places).
Spheroides lunaris, Jordan & Seale, Proc. U. S. Nat. Mus., XXVIII, 1905, 790 (Negros).

265. Tetraodon nigropunctatus Bloch & Schneider. *Doele.*

One specimen from Bacon (no. 4062; length 8.5 in.). This example is uniform black, the spicules silvery white, short and developed only on belly, back, and sides; the caudal, cheeks, snout, chin, and a spot on the middle of back naked; fins black except pectorals which have a slight wash of yellowish.

Tetraodon nigro-punctatus Bloch & Schneider, Syst. Ichth., 507, 1801, **Tranquebar.**
Tetrodon nigropunctatus, Günther Cat., VIII, 293.
Crayracion nigropunctatus, Bleeker, Atlas, v, 74, pl. CCVI, fig. 4.

Family OSTRACIIDÆ.

266. Ostracion tuberculatum Linnæus.

One specimen from Jolo (no. 3764; length 1 in.).

Ostracion tuberculatus Linnæus, Syst. Nat., ed. x, 331, 1758, **India.**
Ostracion cubicus Linnæus, Syst. Nat., ed. x, 332, 1758, **India**; Günther, Cat., VIII, 260 (Red Sea; Zanzibar; Seychelles; Mauritius; Ceylon; Amboyna; Ceram; South Australia).

267. Ostracion gibbosum Linnæus.

One specimen from Jolo (no. 3853; length 2.4 in.).

Ostracion gibbosus Linnæus, Syst. Nat., ed. x, 332, 1758, **India**: Günther, Cat., VIII, 258.
Ostracion turritus Day, Fishes India, 695, pl. CLXXXI, fig. 4.
Ostracion (*Tetrosomus*) *turritus*, Bleeker, Atlas v, 31, pl. CCIII, fig. 3.

Family SCORPÆNIDÆ.

HYPOMACRUS Evermann & Seale, new genus.

Hypomacrus Evermann & Seale, new genus of Scorpænidæ (*Hypomacrus albaiensis*).

This genus is related to *Sebastopsis* Gill, from which it differs in having the tenth to thirteenth pectoral rays much produced. The upper 9 rays are subequal, their length half that of head; length of tenth ray 1.2 in head, the eleventh to thirteenth successively shorter, the last 3 usually shorter than the upper 9 and not detached. (*ὑπα*, under; *μακρος*, long; referring to the produced lower pectoral rays.)

268. **Hypomacrus albaiensis** Evermann & Seale, new species.

Head 2.25 in length without caudal; depth 3.25; eye 3.75 in head; snout 3.75; interorbital 2 in snout; dorsal XIII, 9 (the cotype has the soft dorsal deformed, with only 5 rays); anal III, 5; scales 5–26–13, about 16 tubules in lateral line.

Body moderately compressed, the head rather elongate, the lower jaw projecting, depth of caudal peduncle 4.1 in head; maxillary 2 in head, the distal end under the posterior margin of pupil, its distal width 1.5 in eye; mandible 1.75 in head; villiform teeth on jaws and vomer, none on palatines; gillrakers very small, 8 on lower limb of first arch; spines of head as follows: opercular 2; preopercular 2, the upper the larger, with a small superimposed spine on its base; bony stay across cheek with 2 spines, 4 above eye, 5 on each side of nuchal region; a distinct fringed orbital tentacle equal in length to pupil; a short dermal flap at base of each nuchal spine; a branched flap at nostril, and a rather long preorbital flap hanging over maxillary.

Body entirely scaled, head scaled; origin of dorsal above axil of pectoral, longest spine 3.2 in head; origin of anal under origin of soft dorsal, its longest ray 2 in head, the second anal spine the longest and strongest, 2.3 in head; origin of ventrals about midway between tip of upper jaw and origin of anal, their length 1.85 in head, their tips falling far short of anal; pectoral peculiar, the 9 upper rays short, about 2 in head, their tips scarcely extending past tips of ventrals; the lower part of fin elongate, composed of 7 simple rays, the longest 1.19 in head, their tips beyond line with origin of anal fin; caudal rounded, 1.65 in head.

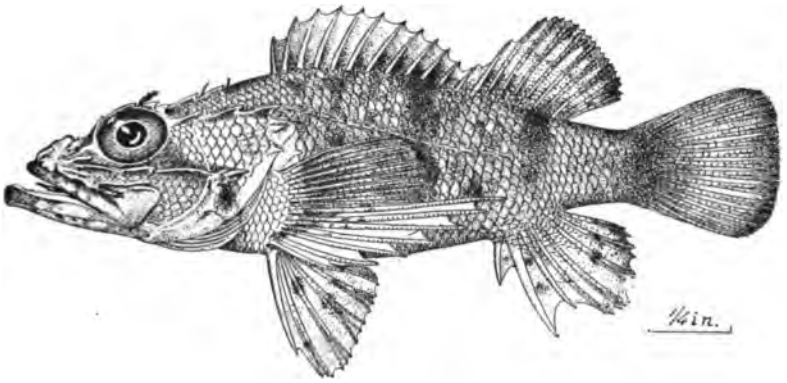

Fig. 20.—*Hypomacrus albaiensis* Evermann & Seale, new species. Type.

Color in spirits, mottled brownish, a large yellowish area occupying entire upper two-thirds of opercle, extending to eye anteriorly, and posteriorly extending down and covering base of pectoral; a round black opercular spot posterior of and between the preopercular spines; about 5 indistinct rather narrow dark bands over back; spinous dorsal with irregular dusky markings, soft dorsal with dark base and tip, the mid portion whitish; anal with irregular dark markings, the most distinctive being a black spot on posterior axil of fin; ventrals shaded with dusky dots posteriorly; pectoral with brown dots on the short rays, the elongate rays white with a few scattered brown dots; caudal dusky at tip, a slight dusky wash on base of rays.

Type, no. 55902, U. S. National Museum, original no. 3866 (10,771), 2.5 inches long, from Bacon, Sorsogon, P. I., collected by Mr. Charles J. Pierson. Cotype, no. 20,006, Stanford University, a specimen 2.25 inches long, also from Bacon.

269. **Sebastopsis scabra** (Ramsay & Ogilby).

One specimen from Bacon (no. 4004; length 2.75 in.).

Sebastes scaber Ramsay & Ogilby, Proc. Linn. Soc. N. S. W., X, 1885, 577, **Shark Reef, Australia.**
Sebastopsis scabra, Jordan & Seale, Proc. U. S. Nat. Mus., XXVIII, 1905 (July 3), 791 (Negros).

270. **Sebastopistes tristis** (Klunzinger).

Three specimens from Bacon (no. 3612 to 3614; length 4 to 4.5 in.). This species is close to *S. nivifer* Jordan & Seale, described from Negros, P. I., differing in the orbital spines, the dermal flaps, and the color.

Scorpæna tristis Klunzinger, Synop. Fische des Rothen Meers, Verh. Zool.-Bot. Gesellsch. Wien, XX, 1870, 802, **Red Sea.**
Scorpæna bakeri Seale, Fishes of Guam, in Occ. Papers Bishop Mus., vol. I, no. 2, 1901, 120, **Guam.**

271. **Pterois volitans** (Linnæus).

Two fine specimens from Bacon (no. 3444 and 3445; length 6.5 and 6.75 in.).

Gasterosteus volitans Linnæus, Syst. Nat., ed. x, 296, 1758, **Amboyna.**
Pterois volitans, Günther, Cat., II, 122 (Egypt; South Africa; Cape of Good Hope; Madras; China; Amboyna).
Pseudomonopterus (*Pterois*) *volitans*, Bleeker, Atlas, IX, pl. CCCCXII, fig. 3.

272. **Dendrochirus zebra** (Cuvier & Valenciennes).

Four specimens from Bacon (no. 3574 and 3577; length 3.5 to 4.75 in.).

Pterois zebra Cuvier & Valenciennes, Hist. Nat. Poiss., IV, 269 (367), 1829, **Ile de France;** Günther, Cat., II, 126 (Amboyna, China; Madagascar).
Pseudomonopterus (*Dendrochirus*) *zebra*, Bleeker, Atlas, IX, pl., CCCCXI, fig. 1.

Family PLATYCEPHALIDÆ.

273. **Platycephalus bataviensis** Bleeker.

One specimen from Jolo (no. 3276; length 8 in.).

Platycephalus bataviensis Bleeker, Nat. Tijds. Ned. Ind., IV, 1853, 460, **Batavia;** Atlas, IX, pl. CCCCXX, fig. 4; Günther, Cat. II, 188.

274. **Platycephalus insidiator** (Forskål). *Lacoy.*

On specimen from San Fabian (no. 3900; length 6.2 in.).

Cottus insidiator Forskål, Descr. Anim., 25, 1775, **Red Sea.**
Platycephalus insidiator, Gunther, Cat., II, 177 (Calcutta; Ganges; China; Malayan Peninsula; Moluccas; Amboyna; Cape York; Australia; Red Sea; Port Natal; Cape of Good Hope).

275. **Platycephalus macracanthus** Bleeker. *Cacabit.*

One specimen from San Fabian (no. 3857; length 5.25 in.).

Platycephalus macracanthus Bleeker, Versl. Meded. Ak. Wet., 2d reeks, III, 1868-9, 253, **Amboyna;** Atlas, IX, pl. CCCCXIX, fig. 1.

Family CALLIONYMIDÆ.

276. **Calliurichthys reevesii** (Richardson).

Four specimens from Bulan (no. 4077 to 4080; length 5.75 to 6.5 in.).

Callionymus reevesii Richardson, Voy. Sulphur, 60, pl. 36, figs. 1-3 (not 4), 1845, **Canton.**

Family NOTOTHENIIDÆ.

277. **Parapercis hexophthalma** (Ehrenberg).

One specimen from Bacon (no. 3721; length 6.2 in.).

Percis hexophthalma Ehrenberg in Cuvier & Valenciennes, Hist. Nat. Poiss., III, 202 (271), 1829, **Massuah;** Günther, Cat., II, 239 (Louisiade Archipelago; Red Sea).

Family OPHICEPHALIDÆ.

278. **Ophicephalus striatus** Bloch.

Five specimens from Philippines (without local label, no. 3791 to 3795; length 3.1 to 4 in.).

Ophicephalus striatus Bloch, Ichth., x, 117, pl. CCCLIX, 1797, **East Indies.**
Ophiocephalus striatus, Günther, Cat., III, 474 (Loodianah; Ganges; Bengal; Pinang; Madras); Bleeker, Atlas, IX, pl. CCCXCIX, fig. 1.

Family GOBIIDÆ.

279. **Butis leucurus** Jordan & Seale.

Three specimens from San Fabian (no. 3858 to 3860; length 3.5 to 4 in.), and one from Bacon (no. 3728; length 3.45 in.). Species originally described from Negros; other specimens collected at Cavite by Dr. Geo. A. Lung and forwarded to Stanford University.

Butis leucurus Jordan & Seale, Proc. U. S. Nat. Mus., xxviii, 1905 (July 3), 794, fig. 13, **Negros Island.**

280. **Glossogobius biocellatus** (Cuvier & Valenciennes).

Two specimens from Bacon (no. 3747 and 3745; length 3.5 and 3.75 in.). Close to *G. giuris*, but lower jaw less prominent, body more robust and head broader.

Gobius biocellatus Cuvier & Valenciennes, Hist. Nat. Poiss., xii, 55 (73), 1837, **Pondicherry**; Günther, Cat., iii, 20; Day, Fishes India, 289, pl. lxiii, fig. 8.

281. **Glossogobius giuris** (Buchanan-Hamilton). *Cacabit.*

Nine specimens from Bacon (no. 3725 to 3727, 3729, 3741 to 3744, and 3749; length 4 to 9 in.), one from San Fabian (no. 3760), and one from Bulan (No. 4128).

Gobius giuris Buchanan-Hamilton, Fishes of the Ganges, 51 and 366, pl. 33, fig. 15, 1822, **Ganges River**; Day, Fishes India, 294, pl. lxvii, fig. 1; Günther, Cat., iii, 21.

282. **Oxyurichthys cristatus** (Day).

One specimen from San Fabian (no. 3929; length 5.8 in.).

Euctenogobius cristatus Day, Proc. Zool. Soc. Lond. 1873, 109, **Bombay.**
Gobius cristatus Day, Fishes India, 291, pl. lxii, fig. 8.

283. **Valenciennea strigata** (Broussonet).

Two specimens from Bacon (no. 3999; length 2.1 in.). Head 3 in length; depth 4.75; scales 150; dorsal vi–i, 18; anal i, 17; anterior dorsal rays elongate. Color white; a blue dark-edged band from angle of mouth to opercle, another indistinct band on preopercle.

Gobius strigatus Broussonet, Ichth., i, 1782, **Tahiti.**
Eleotris strigata, Cuvier & Valenciennes, Hist. Nat. Poiss., xii, 189 (251); Günther, Cat., iii, 131 (Java; Amboyna; Celebes; Booroo; Tahiti); Günther, Fische der Südsee, 190, pl. 111, fig. E.

Family BLENNIIDÆ.

284. **Salarias fasciatus** (Bloch).

Ten specimens from Bacon (no. 3974; length 1.2 to 4 in.).

Blennius fasciatus Bloch, Ichth., v, pl. clxii, fig. 1, 1797.
Salarias fasciatus, Günther, Cat., iii, 244 (Borneo; Philippines; New Holland; Victoria Bank; Fiji Islands; Tonga Islands; Aneityum); Günther, Fische der Südsee, 201, pl. 115, fig. H.

285. **Petroscirtes grammistes** (Cuvier & Valenciennes).

Two specimens from Bacon (no. 3757; length 3.2 in.).

Blennechis grammistes Cuvier & Valenciennes, Hist. Nat. Poiss., xi, 210 (284), 1836, **Java.**
Petroscirtes anema, Günther, Cat., iii, 236 (Amboyna; China); Günther, Fische der Südsee, pl. 115, fig. F.
Petroscirtes grammistes, Günther, Fische der Südsee, 197 (Yap; Kusaie; Amboyna).

Family ECHENEIDÆ.

286. **Echeneis naucrates** Linnæus.

One specimen from Bulan (no. 3740; length 10.5 in.).

Echeneis neucrates (misprint for *naucrates*) Linnæus, Syst. Nat., ed. x, 261, 1758, **Pelago Indico**; Günther, Cat., ii, 384 (many localities); Jordan & Evermann, Fishes North and Mid. Amer., 2269, 1898.

Family PLEURONECTIDÆ.

287. **Platophrys javanicus** (Bleeker). *Palad.*

One specimen from Bulan (no. 4049; length 8.25 in.). Anal 51; scales 74.

Rhombus javanicus Bleeker, Nat. Tijds. Ned. Ind., IV, 502, Batavia.
Pseudorhombus javanicus, Bleeker, Atlas, VI, 8, pl. CCXXXII, fig. 3; Günther, Cat., IV, 427 (Java); Day, Fishes India, 424, pl. XCII, fig. 2.

288. **Platophrys russellii** (Gray).

One specimen from Bulan (no. 4069; length 9 in.). Anal 59; scales 74.

Platessa russellii Gray, Ill. Ind. Zool., fig. 2.
Pseudorhombus russellii, Günther, Cat., IV, 424 (Umbilo River, Port Natal).

289. **Platophrys neglectus** (Bleeker). *Uguerangueray.*

Three specimens from San Fabian (no. 3390, 3619 and 3620; length 3.5 to 6.75 in.). Anal 57; scales 81.

Pseudorhombus neglectus Bleeker, Ned. Tijds. Dierk., III, 45, and Atlas, VI, 8, pl. CCXXXIV, fig. 1.

290. **Platophrys pantherinus** (Rüppell).

Two specimens from Bacon (no. 3409 and 3494; length 5.2 and 6 in.).

Rhombus pantherinus Rüppell, Atlas, 121, pl. 31, fig. 1, 1828, Red Sea.
Platophrys pantherinus, Bleeker, Atlas, VI, 11, pl. CCXXXIII, fig. 3; Day, Fishes India, 425, pl. XCII, figs. 3 and 4; Jordan & Evermann, Bull. U. S. Fish Comm., XXIII, 1903 (1905), 512.
Rhomboidichthys pantherinus, Günther, Cat., IV, 436 (Mauritius; Madagascar; Amboyna; Fiji).

291. **Platophrys palad** Evermann & Seale, new species. *Palad.*

Head 3.75 in length; depth 2.4; eye 6 in head; snout 4; maxillary 2.3, its distal end under middle of eye; dorsal 77; anal 60; scales 85; interorbital a very narrow trenchant ridge slightly higher than eye; jaws equal; canine teeth in anterior of jaws; gillrakers short and blunt, broader than long, 9 on lower limb, the curved portion of lateral line 3.5 in straight, the depth of the curve 3.1 in its length; longest dorsal ray 2.75 in head; longest anal ray 2.1 in head; colored pectoral 2 in head; caudal rounded, 1.25 in head. Color on left side.

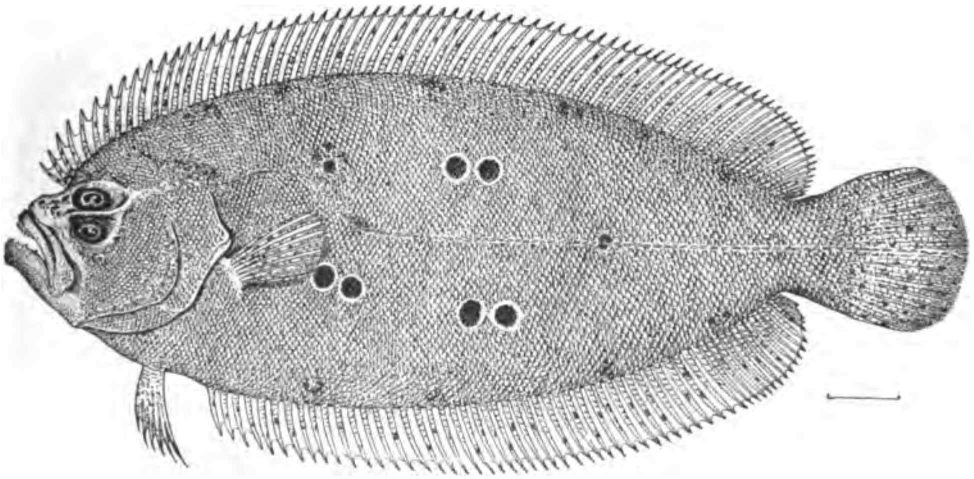

FIG. 21.—*Platophrys valad* Evermann & Seale, new species. Type.

Color in spirits, brownish; on each side of lateral line 2 large ocelli, each inclosing 2 large black spots; 2 very indistinct dusky blotches on the lateral line, one at posterior curve of lateral line, the other at the beginning of posterior third of body; a row of indistinct ocelli at base of each vertical fin; numerous dusky dots and blotches on fins.

One large specimen from Bulan (no. 4050; length 15.5 in.). Type, no. 55898, U. S. National Museum, collected by Charles J. Pierson.

292. **Psettodes erumei** (Bloch & Schneider). *Uguerangueray.*

Two specimens from San Fabian (no. 3848 and 3849; length 4.75 and 6.5 in.). Head 3.6 in length; depth 2.5; eyes on right side. It may be that the sinistral specimens recorded by Günther and Bleeker are a different species.

Pleuronectes erumei Bloch & Schneider, Syst. Ichth., 150, 1801, "ad Tranquebarium."
Psettodes erumei. Günther, Cat., IV, 402 (China; Amboyna; Pinang; India); Day, Fishes India, 422, pl. XCI, fig. 4; Bleeker, Atlas, VI, 4, pl. CCXXXII, fig. 2.

Family SOLEIDÆ.

293. **Achirus hartzfeldii** Bleeker.

One specimen from "Philippine Islands" (no local label; no. 4012; length 4.5 in.). Anal 63; lateral line 98.

Achirus hartzfeldii Bleeker, Nat. Tijds. Ned. Ind., IV, 1853, 123, Amboyna; Atlas, VI, 25, pl. CCXLVI, fig. 1.
Aseraggodes hartzfeldii, Kaup, Archiv f. Naturgesch., jhg. XXIV, 1858, bd. I, 103.
Solea hartzfeldii, Günther, Cat., IV, 471 (Amboyna).

294. **Synaptura sorsogonensis** Evermann & Seale, new species.

Head 5.25 in length without caudal; depth 2.37; dorsal 74; anal 61; caudal 15; dorsal and anal continuous with caudal; pores of lateral line 141, of which 29 are in the short curved portion above the head; interorbital space scaled, scarcely greater than diameter of lower eye; upper eye covered by skin; the beaklike snout not extending around to a line with eye; upper nostril a distinct hollow papilla located in front of lower eye; nostril of blind side greatly dilated and fringed; anterior part of head with numerous dermal fringes; dermal flaps scattered in groups over different portion of body, 4 such groups on lateral line and 4 on each side of body, alternating with the groups on lateral line; smaller groups along base of dorsal and anal fin; lateral line straight until it reaches head, where it makes a sharp curve ending on a line with anterior margin of upper eye; gillrakers obsolete; colored pectoral 3.75 in head; uncolored pectoral 4; dorsal beginning on snout in front of eyes, its middle ray 1.85 in head; middle anal ray 2 in head; colored ventral 2.9; caudal 1.3.

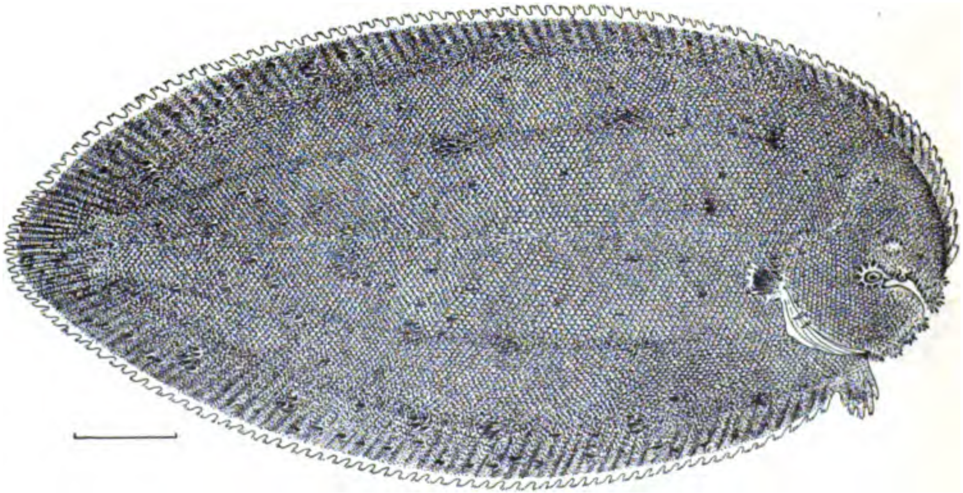

FIG. 22.—*Synaptura sorsogonensis* Evermann & Seale, new species. Type.

Color in spirits, brownish, the groups of dermal flaps described above blackish; colored pectoral black, tipped with white; margin of dorsal and anal white with a submarginal dusky area, more easily distinguished on under side.

This species is related to *S. pan*, but is distinguished by the greater number of rays and the dilated nostril.

One fine specimen from Bacon, Sorsogon, no. 4133 (10,825); length 9 in., type, no. 55916, U. S. National Museum, collected by Charles J. Pierson.

295. **Pardachirus pavoninus** (Lacépède).

One specimen from Bacon (no. 3383; length 5.5 in.). Anal 56; lateral line 100.

Achirus pavoninus Lacépède, Hist. Nat. Poiss., iv, 658 and 661; Bleeker, Atlas, vi, 24, pl. ccxli, fig. 1.
Pardachirus pavoninus, Günther, Cat., iv, 479 (Pinang; Singapore; Moluccas).

296. **Soleichthys heterorhinos** (Bleeker).

One specimen from Bacon (no. 3927; length 4.2 in.). Anal 78; lateral line 112.

Solea heterorhinos Bleeker Visch fauna Amboina, 64, Act. Soc. Sc. Indo-Ned., i. 64, 1856, Amboyna.
Solea heterorhinus, Bleeker, Atlas, vi, 17.
Solea heterorhina, Günther, Cat., iv, 466 (Celebes, Amboyna); Bleeker, Atlas, vi, pl. ccxc, fig. 2; Day, Fishes India, 426, pl. xcii, fig. 5.

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A CESTODE PARASITE IN THE FLESH OF THE BUTTERFISH.

By EDWIN LINTON, Ph. D.

BUREAU OF FISHERIES DOCUMENT NO. 611.

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A CESTODE PARASITE IN THE FLESH OF THE BUTTERFISH.

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HISTORICAL ACCOUNT.

During the summer of 1904, at the laboratory of the Bureau of Fisheries at Woods Hole, Mass., while I was engaged in the study of helminth parasites of fishes, a particular case of parasitism was called to my attention by Dr. Lynd Jones, who had observed the frequency of a parasite in the flesh of butterfish, *Poronotus, triacanthus*, which he had been feeding to terns.

The parasites occur in the muscle tissue of their host in the form of small cysts usually less than 1 millimeter in length. Each cyst consists of a connective-tissue envelop surrounding a plerocercus (blastocyst) in which is the scolex of a cestode worm. In most of the cases examined the scolex was found to be sufficiently developed to admit of its being referred to the species *Otobothrium crenacolle*. The adult of this species, first found by me in the spiral valve of the hammerhead shark (*Sphyrna zygæna*), was made the type of a new genus.[a]

The genus *Otobothrium* is distinguished from *Rhynchobothrium* by the presence of two supplemental eversible organs on each of the two bothria. These supplemental organs are covered with minute spine-like bristles, and appear either as small pits or small papillæ, depending on whether they are inverted or everted. In 1901 I recorded from the muscles of the butterfish cestodes that should have been referred to this species, but, their real nature not being recognized at that time, they were wrongly placed in the genus *Rhynchobothrium*.[b] For the purpose of comparison with observations recorded for the first time in this paper, I make the following extract from the record cited:

> On August 26, 1899, 2 butterfish * * * were submitted to me by Dr. C. Judson Herrick. * * * The muscles between the ribs contained great numbers of small cysts. When one of these was compressed, a blastocyst was liberated, from which, upon further pressure, a larval cestode * * * could be obtained. Forty of these cysts were counted in a space 4 millimeters square.
>
> Similar conditions were observed in a butterfish brought to me by Mr. E. E. Tyzzer August 17, 1900, and in another examined the following day.

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[a] Linton, Notes on Entozoa of marine fishes of New England. Report of the Commissioner of Fish and Fisheries for 1887, p. 849–853, pl. XIII, fig. 9–15, and pl. XIV, fig. 1–4.

[b] Linton, Parasites of fishes of the Woods Hole region. U. S. Fish Commission Bulletin for 1899, vol. XIX, p. 453–454, pl. XXIII, fig. 255–256a, and pl. XXIV, fig. 265.

In these cases enormous numbers of cysts were seen in the muscles. They were most abundant on the ventral side of the vertebral column, between the subvertebral spines. They were also scattered through the dorsal region, lying deep among and near the dorsal vertebral spines. The cysts are small, oval, about 1 mm. in length and somewhat less in shorter diameter. * * * Dimensions of larva in millimeters: Length, 0.7; bothria nearly circular, 0.3 in diameter; diameter of neck, 0.1. Contractile bulbs very short.

Since the foregoing record was made I have found this parasite in a number of different hosts at Beaufort, N. C.[a], Woods Hole, Mass., and in Bermuda. Details of these finds are given in my reports on these localities and a list of the hosts is given later in this paper.

Beginning with August 8, 1904, a systematic search was made for these parasites in the flesh of the butterfish and examinations were made on nine different dates that season, the last on October 12. The fish came from Buzzards Bay, near the village of Woods Hole; Nomans Land, a small island which lies some five miles at sea off the western end of Vineyard Sound; Montauk, Long Island, and Barnegat, N. J. In all, 188 fishes were examined, of which only one-half of 1 per cent were without parasites in the flesh, and 75 per cent were badly infested. Prior to August 8 a few butterfish had been examined, but search was made only on and in the viscera. Of these examinations I find in my notes on the dates July 20 and 25 mention of finding on the viscera small cysts containing living blastocysts, which, though not sufficiently developed for certain identification, are very probably *Otobothrium crenacolle*. It is somewhat surprising in the light of the subsequent discovery of the prevalence of this parasite in the flesh of the butterfish, and in the intestinal walls of many other fish, that the viscera of the butterfish should be so free from it.

During the summers of 1905 and 1906 the search for parasites was continued and a total of 331 fish were examined. Of these 42 per cent were badly infested, and only 11 per cent revealed no parasites.

DESCRIPTION OF SCOLEX, CYST AND BLASTOCYST.

Scolex.—In most cases where the cysts were opened the scoleces were found to be sufficiently developed to admit of identification. So far as can be determined from the scolex alone the species is *Otobothrium crenacolle*. The bothria agree closely with those of the adult as found in the spiral valve of the hammerhead. The proportions of the head and neck, the blunt salient angles, and the crenulate border of the posterior end of the neck produced by the diverging posterior ends of the contractile bulbs are all in close agreement with similar features in the adult. The hooks on the proboscides, although seen to present considerable variety, are not in disagreement with what I have observed in the adult (fig. 12–16). The peculiar accessory organs on the bothria were found to be present in all scoleces that possessed well-developed proboscides, and they were found to have longer bristles than was noted in the original descriptions (fig. 10, 11). They are eversible, and together with the proboscides often showed signs of life where the scolex was otherwise quiescent.

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[a] Linton, Parasites of fishes of Beaufort, North Carolina. Bulletin Bureau of Fisheries, vol. XXIV, 1904, p. 321–428, pl. I–XXXIV.

Cyst and blastocyst.—The walls of the cysts are comparatively thin, and in sections are seen to be made up of a few concentric layers of connective tissue.

The plerocercus or blastocyst has a large number of comparatively coarse calcareous bodies in the parenchyma; abundant contractile fibers occur in its wall, whose outer layer is a dense cuticle. Each blastocyst contains a single scolex.

The cysts lie both in the connective tissue septa and in the midst of the muscle bundles. While the usual shape is oval, with longer diameter about 1 millimeter or less, and the shorter diameter approximately two-thirds of the longer, a considerable variety may be found where a large number of cysts is examined. For example, among cysts removed from a fish in the lot from Barnegat, N. J., the following dimensions, in millimeters, were recorded:

	Longer diameter.	Shorter diameter.
	mm.	*mm.*
1...	0.57	0.57
2...	0.75	0.52
3...	0.90	0.75
4...	1.12	0.75
5...	1.35	0.75
6...	1.66	0.45

In this lot the following additional measurements were made: Diameter of proboscis, with hooks, 0.023; without hooks, 0.014; length of longer hooks, 0.008. Figures 12–16 show more variation in size and shape of hooks in different parts of the proboscis than has been hitherto recorded for this species.

DISTRIBUTION AND NUMBER OF CYSTS IN BUTTERFISH.

The distribution of the cysts in the body of the fish is determined, in some degree at least, by the position of the principal blood vessels. This is indicated by the great uniformity which is maintained in the areas of infection. In all cases where fish were found to be badly infested the greatest number of cysts was found on the ventral side of the backbone, approximately halfway between the abdominal cavity and the base of the caudal fin as in figure 1. While this drawing was made from an actual dissection, it might well be a generalized sketch or composite of all the more badly infested fish.

There are in general four areas of greatest infection. Named in the order of the greatest number of cysts in each they are:

1. Below the backbone between the abdominal cavity and the caudal fin.
2. Below the backbone and above the caudal third of the abdominal cavity.
3. Above the backbone and opposite area 1.
4. Above the backbone, opposite area 2, about halfway between the backbone and the dorsal surface.

There was also observed, in a considerable number of the more badly infested fish, a cluster of cysts close behind the caudal border of the skull (fig. 1). Not all the fish opened were examined for parasites in this position, but enough to make the conclusion very probable that all badly infested fish have this cluster of cysts behind the skull. None were found to occupy this position except in fish which harbored large numbers of parasites, and they were found in all the badly infested fish in which special search was made for them.

If these cysts are present in the muscles of a fish they are easily found by splitting the fish and removing the flesh from one side of the skeleton. If the fish is badly infested it will be found to present some such appearance as that shown in figure 1. When an infested fish has been opened in this manner, while many cysts may be found in the muscle tissue which has been removed, a much larger number will be found on the skeletal portion, where they lie in greatest numbers between the vertebral spines. Masses of cysts completely filling the interspinous spaces, especially on the ventral side of the vertebræ, were of common occurrence. Some of these masses were as much as 5 and 10 millimeters in length and 3 and 4 millimeters thick. Since an interspinous space is not far from 5 millimeters wide it may be seen, allowing a cyst to occupy a space equivalent to a sphere 1 millimeter in diameter, that from 120 to 400 cysts may be found in a single interspinous space. This theoretical estimate was abundantly verified by calculations based on actual count. Many of the badly infested fish also had numerous cysts lateral to the centra of the vertebræ, especially in that part of the backbone lying dorsal to the abdominal cavity.

The cysts are easily recognized without the aid of a lens. Their outline is usually short oval. Their color is in some cases a translucent bluish white, in others ivory white, in others yellowish white.

DETAILS OF EXAMINATIONS OF BUTTERFISH FOR CYSTS.

August 8, 1904.—One. Cysts very numerous in the flesh. This specimen was submitted to me by Dr. Lynd Jones, who stated that he had noticed these small cysts in the flesh of butterfish which he had been feeding to terns, while he had seen nothing of the kind in other fish which he had been cutting up for the same purpose.

On the same date two other fish were examined. Cysts were found in large numbers in each. While these cysts were somewhat variable in size, they did not exceed 1 millimeter in length. Measurements of a typical one yielded the following results in millimeters: Length 0.75, breadth 0.60; the blastocyst when liberated from the cyst contracted and extended itself actively and varied from 0.4 to 0.7 in length; the larva, liberated from the blastocyst, also active, measured 0.67 in length.

August 13.—Six fish were examined for parasites in the muscle tissue and were all found to be infested. Two had few parasites, one had many, and each of the other three had enormous numbers. The cysts were oval and 0.8 by 0.7 millimeter in the two principal diameters. The favorite resting place of the cysts is on the ventral side of the vertebral column, between and near the ventral spinous processes. In the most highly parasitized fish the underside of the backbone from a point opposite the insertion of the pectoral fin to the tail was thickly beset with cysts. The maximum number occurred in a region between the seventh and twelfth vertebra from the tail. It was estimated that 1,200 cysts were exposed in a fish 21 centimeters in length laid open as shown in fig. 1, but since many of the cysts could not be seen, the actual number in the fish was much greater than this. The region above the backbone, while not having so many cysts as the ventral region, still had large numbers. These were most abundant between the dorsal spinous processes of about the seventh to the tenth or twelfth vertebra from the tail, and in the thoracic region, about halfway between the backbone and the dorsum. Both above and below the backbone cysts were scattered more or less thickly for a distance of 25 to 30 millimeters from the vertebræ. In those fish which had but few parasites the cysts were widely scattered both above and below the backbone. In some places cysts were seen lying as close as it was possible for them to lie in spaces as much as 5 millimeters square, the clusters having a thickness of 2 or 3 millimeters.

August 17.—Two fish, 187 and 200 millimeters in length, respectively, were examined and each found to be badly infested. Another, 75 millimeters in length, was examined at the same time, but no cysts were found in its flesh.

August 18.—Eight fish examined. Two of these, 50 and 75 millimeters in length, respectively, had no cysts in the flesh. The others, 125 to 175 millimeters in length, each had cysts in the flesh. These cysts, as in other instances observed, were most abundant about the posterior third on the ventral side of the backbone between the ventral spines.

August 24.—Fourteen fish from 175 to 206 millimeters in length, and one 106 millimeters in length, were examined. Cysts were numerous in all the larger fish, and very numerous, i. e., several thousand, approximately, in all but two or three of the fourteen. In the small specimen only two cysts were found, although careful search was made. One of these was a little back of the middle and near the ventral side of the backbone; the other was at about the posterior third and halfway between the backbone and the dorsal surface of the body. These two cysts were ivory white. One of them contained a scolex; in the other a scolex had not yet developed.

In the badly infested fish cysts were most abundant along the backbone between the vertebral spines. The cysts were most abundant on the ventral side of the backbone in most of the fish. A few of the fish had the cysts massed in a space two or three centimeters in extent on the ventral side of the backbone, a short distance behind the abdominal cavity. The cysts in a few other instances were most abundant about the middle of the body—as many above as there were below the backbone. The color of the cysts, except in the case cited above, was yellowish, enough to make a fairly sharp contrast with the flesh of the host. Apparently the larger fish had been affected with these flesh parasites for some time. Most of them were in rather poor condition. So far as examined it was found that the usual immature nematodes were present on the abdominal viscera, but not in unusual numbers.

August 26.—Seventy-three fish examined. Of these, 57 ranged in length from 190 to 210 millimeters; the remaining 14 were from 146 to 162 millimeters in length. Cysts were found in the flesh of every one of the 73. They were very numerous in 51 of the 57 larger fish. Even those of the 51 which were least infected still harbored approximately several thousand cysts. The remaining 6 of the larger fish had few cysts—that is to say, upon splitting one of them only a few scattering cysts were seen, or, in a few cases, clusters with the cysts somewhat scattered. The number of cysts visible in a split fish, in these slightly parasitized specimens, varied from a dozen or less to 50 or more.

The distribution of cysts was in general in agreement with what has been given under previous dates. In the worst cases the cysts were collected in dense granular masses which filled completely several of the interspinous spaces both above and below the backbone. In those which were most infested there were also clusters of cysts in the head just behind the skull. A few cysts were seen below the ventral end of the abdominal cavity, and a few also on the viscera. In the larger fish the cysts were usually yellowish, and contained mature scoleces; in the smaller fish they were for the most part white, and, so far as examined, with immature scoleces. In cases of slight infection the cysts were found scattered at irregular intervals above and below the backbone, prevailingly behind the abdominal cavity. In many of the fish which were only slightly parasitized, clusters of cysts, 20 or 30 in each cluster, were lodged above the body cavity but below the backbone.

Of the 14 smaller fish, 4 had many cysts in the flesh; the remaining 10 had few. One of them, the smallest in the lot, was at first thought to be free of cysts, but upon a careful examination one cyst was found below the backbone about the posterior third.

The scoleces from cysts in the smaller fish, so far as examined, were immature, most of them with hooks not yet developed on the proboscides, nor accessory organs on the bothria; scoleces from cysts in the larger fish had hooks on the proboscides and accessory organs on the bothria.

The cysts vary somewhat in size, but the usual diameter was from 0.5 to 0.7 millimeter. The blastocysts have the parenchyma filled with relatively coarse calcareous bodies. The calcareous bodies in the scoleces are numerous, but very much smaller than those of the blastocysts.

August 30.—Sixty-nine fish were examined. These were taken in a fish pound at Nomans Land on the 29th. Each fish in this lot was split open so as to expose the vertebræ with the dorsal and ventral vertebral spines. Details of infection are given in the table below. In general, it may be said that practically every fish harbored parasites in the flesh. In the few cases where no parasites were seen, it is to be noted that what is meant is that no parasites were seen in the median section of the fish. In a few of the fish in which at first no cysts were seen, further search by scraping off some of the flesh brought one or more cysts into view. The smallest fish had fewest cysts, and the cases of most numerous cysts occurred among the largest fish.

The number of cysts visible in a single interspinous space was found to be from 100 to 150 in two of the worst cases of infection. In such cases from 10 to 12 contiguous interspinous spaces contained each approximately the same number of cysts. This does not represent the actual number of cysts, but only those which could be seen without further dissection than is involved in laying the fish open in the manner described above.

The following table contains a record of cysts seen on the exposed surface of each of the 69 fish of this lot opened as above described. The number, where not specifically stated, is indicated approximately by the words "few," "several," "scattering," "many," "numerous," and "very numerous." In a few cases the parasites occurred in a single cluster, consisting of from 12 to 30 or more cysts. It should be noted that in all the badly infested fish cysts occurred, often in large numbers, lateral to the backbone, and immediately behind the skull. The fourth specimen in the list had also a few cysts on the viscera. The viscera of only a few of this lot, however, were examined.

Table Showing Distribution of Cysts in the Principal Regions of Infection in a Lot of 69 Butterfish.

	Length of fish.	Cysts above backbone.		Cysts below backbone.	
		Anterior.	Posterior.	Anterior.	Posterior.
	cm.				
1	11	None	None	None	None.
2	11	do	do	do	do.
3	11	do	do	One	do.
4	11	do	do	Few	do.
5	13-14	Few	Two	Several	One.
6	13-14	None	None	One	None.
7	13-14	do	Several	None	Three.
8	13-14	do	None	Several	Several.
9	13-14	do	do	One	None.
10	13-14	do	do	None	Two.
11	13-14	do	do	Cluster	do.
12	13-14	do	do	do	do.
13	13-14	do	do	One	None.
14	13-14	Few	do	Cluster	Two.
15	13-14	do	do	Many	Many.
16	13-14	do	do	None	None.
17	13-14	Several	do	do	do.
18	13-14	Few	Few	Few	Few.
19	13-14	None	do	do	None.
20	13-14	do	Two	None	do.
21	13-14	do	Few	Few	do.
22	13-14	Few	do	Many	Many.
23	13-14	do	None	None	None.
24	13-14	do	do	Many	do.
25	13-14	Many	Many	Numerous	Numerous.
26	13-14	do	do	Very numerous	Very numerous.
27	13-14	None	Few	Many	Many.
28	13-14	Few	do	do	do.
29	13-14	do	None	None	None.
30	13-14	do	do	do	One.
31	13-14	do	do	Many	Few.
32	13-14	do	do	do	do.
33	13-14	do	do	Cluster	None.
34	13-14	Many	Few	Very numerous	Very numerous.
35	13-14	Few	do	Cluster	Few.
36	13-14	None	One	Few	do.
37	13-14	do	None	Several	do.
38	13-14	Few	Few	Many	Many.
39	13-14	One	do	do	None.
40	13-14	Few	do	Several	Several.
41	13-14	Numerous	Many	Very numerous	Very numerous.
42	13-14	None	do	Two	One.
43	13-14	do	One	None	None.
44	13-14	do	None	Few	Few.
45	13-14	do	do	do	do.
46	13-14	Few	Few	Many	Many.
47	13-14	do	do	do	do.
48	13-14	Many	Numerous	Very numerous	Very numerous.
49	13-14	None	None	None	Few.
50	18-21	Numerous	Numerous	Very numerous	Very numerous.
51	18-21	None	None	Two	None.
52	18-21	Scattering	Scattering	Many	Many.
53	18-21	Few	Two	do	Few.
54	18-21	Many	Many	Numerous	Numerous.
55	18-21	Few	Few	Many	Many.
56	18-21	None	None	Several	None.
57	18-21	Few	Few	Many	Many.
58	18-21	Many	Numerous	Numerous	Very numerous.
59	18-21	Scattering	Scattering	do	Many.
60	18-21	Many	Many	do	Numerous.
61	18-21	do	do	do	do.
62	18-21	do	do	do	Very numerous.
63	18-21	do	do	do	do.
64	18-21	do	Few	Many	Many.
65	18-21	Numerous	Many	Numerous	Very numerous.
66	18-21	Few	Few	Many	Many.
67	18-21	do	do	Numerous	do.
68	18-21	do	Very numerous	Very numerous	Very numerous.
69	18-21	do	Few	Many	Many.

September 20.—Twelve fish examined. These were taken at Montauk, Long Island, and sent to me from Blackford's, Fulton Market, New York. Cysts were found in 11 of the 12 fish, distributed in general as has been described in preceding cases.

TABLE SHOWING OCCURRENCE OF CYSTS IN FLESH OF 12 BUTTERFISH FROM MONTAUK, LONG ISLAND.

	Length of fish.	Cysts above backbone.		Cysts below backbone.	
		Anterior.	Posterior.	Anterior.	Posterior.
	cm.				
1	20.0	Numerous	Numerous	Numerous	Very numerous.
2	20.0	Many	Many	Many	Numerous.
3	20.0	None	None	None	Few.
4	20.0	Few	Few	Few	Very numerous.
5	20.0	None	None	None	Few.
6	18.5	do	do	do	do.
7	16.5	One	do	Numerous	Very numerous.
8	16.5	Numerous	Many	do	do.
9	16.5	do	Very numerous	do	do.
10	16.5	Many	Numerous	Many	Numerous.
11	15.0	Few	Few	Very numerous	Very numerous.
12	15.0	None	None	None	None.

In no. 9 cysts were also very numerous lateral to the backbone in the middle of the body, and a few were seen in the ventral muscles of the post-abdominal region. The usual immature nematodes were abundant on the viscera, but no cysts were noted in the body cavity.

October 12.—Twelve fish examined. These were caught at Barnegat, N. J., and were sent to me from Blackfords, Fulton Market, New York.

TABLE SHOWING DISTRIBUTION OF CYSTS IN 12 BUTTERFISH FROM BARNEGAT, N. J.

	Length of fish.	Cysts above backbone.		Cysts below backbone.	
		Anterior.	Posterior.	Anterior.	Posterior.
	cm.				
1	17.0	Few	Few	Many	Very numerous.
2	17.0	do	do	Very numerous	do.
3	17.0	do	do	Numerous	do.
4	17.0	do	do	Many	Many.
5	17.0	do	do	Numerous	Very numerous.
6	18.0	do	do	Many	Many.
7	19.0	do	do	do	do.
8	19.5	do	Many	Very numerous	Very numerous.
9	20.0	do	Few	Numerous	do.
10	20.0	Numerous	Numerous	Very numerous	do.
11	21.0	Many	Many	Many	Numerous.
12	22.0	Numerous	Numerous	Very numerous	Very numerous.

Most of these fish had many cysts also along the lateral borders of the vertebræ. In no. 12 there were enormous numbers of cysts below the backbone caudad of the abdominal cavity, where they were scattered through the muscles generally. A cluster of about 100 cysts lay immediately behind the skull.

Some blastocysts with the contained scoleces were removed from their cysts and found to be still living. A number of cysts were placed in normal salt solution and examined from day to day for over a week. They were found to show signs of life on the evening of the 19th. The last signs of activity were seen in the proboscides.

Summers of 1905 and 1906.—The results of the examination of butterfish for parasites during these periods are given in the following table:

TABLE SUMMARIZING RESULTS OF THE EXAMINATION OF BUTTERFISH FOR FLESH PARASITES AT WOODS HOLE, MASS., IN THE SUMMERS OF 1905 AND 1906.

Date.	Number of fish.	Length.	Number of fish showing—			
			No cysts.	Few cysts.	Many cysts.	Numerous cysts.
1905.		*cm.*				
July 14	1	16.5	1	......	......	......
	1	18.4	......	......	1	......
	1	22.7	......	1	......	......
July 15	1	15.5	......	......	......	1
	4	20.7	......	......	1	3
	1	21.2	......	......	......	1
July 17	1	16	1	......	......	......
	1	18	......	......	......	1
	7	21-22	......	6	......	1
	8	23-26	......	6	1	1
July 18	23	20-25	......	14	4	5
July 22	1	15	......	......	......	1
	1	19	......	......	......	1
	9	20	......	4	3	2
	1	25	1	......	......	......
July 24	1	16	......	......	......	1
	3	17	......	......	......	3
	17	21-22	1	10	......	6
	2	24	......	2	......	......
July 27	1	15	1	......	......	......
	7	20-21	......	1	4	2
	1	23	......	......	......	1
August 3	4	12	2	2	......	......
	1	13	......	1	......	......
	1	14	......	1	......	......
	4	15	......	2	......	2
	1	17	......	......	......	1
	1	21	......	1	......	......
	1	22	......	......	......	1
	1	23	......	1	......	......
August 4	1	15	......	......	1	......
	2	18	......	1	......	1
	4	20	......	1	1	2
	2	21	......	......	1	1
	1	22	......	1	......	......
August 5	5	20	1	......	2	2
August 7	1	17	......	......	......	1
	5	21-22	......	2	1	2
	2	22	......	1	......	1
August 8	3	13	2	1	......	......
	1	15	......	......	1	......
	9	20	1	1	1	6
	3	17	......	1	1	1
	12	21	1	2	2	7
August 10	1	23	......	......	......	1
	1	26	......	......	......	1
August 14	1	11	1	......	......	......
	1	20	......	1	......	......
	1	21	......	......	1	......
August 15	1	10	1	......	......	......
	1	15	......	......	......	1
	6	17-18	......	1	2	3
	12	20-21	......	2	2	8
	8	23-24	1	5	......	2
1905.		*cm.*				
August 18	4	11	3	1	......	......
	4	15	......	1	......	3
	3	17	......	2	......	1
	12	20	......	1	1	10
	4	21	......	1	1	2
August 21	3	11	2	1	......	......
	1	12	......	......	1	......
	2	17	1	1	......	......
	2	19	......	......	1	1
	4	20	......	......	1	3
	5	22	......	3	......	2
August 22	7	11	2	5	......	......
	3	15	1	2	......	......
	2	17	......	......	......	2
	3	18	......	3	......	......
	13	20-21	......	3	1	9
	1	22	......	1	......	......
1906.						
July 26	1	17	......	......	......	1
	2	21	......	1	......	1
July 27	1	16	......	1	......	......
	3	18	......	......	2	1
	9	21	1	2	......	6
	1	22	......	......	......	1
August 2	2	19	......	......	......	2
	2	20	......	......	......	2
	2	22	......	......	......	2
August 4	1	18	......	......	......	1
	1	21	......	......	......	1
	4	22	......	......	1	3
August 7	3	15	1	1	1	......
	3	17	1	2	......	......
	1	19	......	......	......	1
August 8	2	16	1	1	......	......
	2	19	......	1	......	1
	2	21	......	......	......	2
August 9	1	14	1	......	......	......
	1	15	......	......	1	......
	3	20	......	......	2	1
	1	21	......	......	......	1
August 10	4	10	4	......	......	......
	2	15	2	......	......	......
	1	16	......	1	......	......
	1	19	......	......	......	1
	3	21	......	2	......	1
August 11	2	10	2	......	......	......
	3	15	1	1	1	......
	1	19	......	......	......	1
	1	20	......	......	......	1
	1	22	......	......	......	1
Total	331	......	38	110	44	139

HABITATS OF THE PARASITE.

The following list of hosts in which this species has been found is a compilation of both published and unpublished notes of my collections made at Woods Hole, Mass., Beaufort, N. C., Tortugas, Fla., and in Bermuda.

ADULT STAGE.

In spiral valve of the following hosts:

Carcharhinus obscurus (?). Dusky Shark.

Beaufort, N. C.:
1902—Aug. 26, few.

Carcharhinus platyodon.

Tortugas, Fla.:
1906.—July 12, two small specimens.

Scoliodon terræ-novæ. Sharp-nosed Shark.

Beaufort, N. C.:
1901.—July 16, one, length 10 mm.; free segments, length 3 mm.
July 18, two.
July 22, six, length 4 to 7 mm.; posterior segments easily detached.
July 22, three.
August 15, one.
1902.—July 11, twenty-nine from one shark; also numerous cysts with scoleces in stomach wall.

This shark was examined on 18 other occasions when this parasite was not found. All the sharks of this species which were examined were, with one exception, small, 25 to 30 cm.; one measured about 100 cm.

Sphyrna zygæna. Hammerhead.

Woods Hole, Mass.:
1886.—July 28, one hundred and fifty.
1887.—July 18, one hundred.
Chyle swarming with free proglottides in each case.
1898.—July 21, three.

A small hammerhead was examined on August 5, 1898, another on August 18, and another on July 31, 1899. *Otobothrium crenacolle* not found on either date.

ENCYSTED STAGE.

Balistes carolinensis. "Turbot."

Bermuda:
1903.—July 14, a few small cysts in walls of stomach and intestines.
July 22, a few cysts in intestinal wall.

The closely related species *Balistes vetula* was examined also. There were numerous cysts in the intestinal wall, but all that were opened contained only chalky, degenerate tissue, with no trace of parasite.

Bairdiella chrysura. Yellow-tail.

Beaufort, N. C.:
1901.—Aug. 12, small cysts on viscera; scoleces immature and not certainly identifiable.
Aug. 15, scoleces in cysts on viscera.
1902.—July 17, cysts on viscera.
July 19, cysts on viscera and in mesentery.
Aug. 8, cysts on viscera and in mesentery few.

This host was examined on 4 other occasions in 1901 and on 12 other occasions in 1902 when these parasites were not found.

Carcharhinus obscurus (?). Dusky Shark.

Beaufort, N. C.:
1902.—July 11, several noted in ellipsoidal cysts in stomach wall between submucous and muscular coat.
July 26, immense numbers encysted in stomach wall. Dimensions in millimeters, specimen slightly compressed: length of blastocyst, 1.5; breadth, 0.9; larva, length, 0.41.
Woods Hole, Mass.:
1905.—Aug. 11, one shark examined. Numerous cysts were found between the mucous and muscular layers of the stomach wall.

Coryphæna hippurus. Dolphin.

Beaufort, N. C.:
1902.—Aug. 1, very numerous, encysted in submucous coat of stomach.

Cynoscion nebulosus. Speckled Trout.

Beaufort, N. C.:
1901.—July 15, cysts very numerous between muscular coat and submucosa of stomach.
July 22, large numbers of cysts in stomach wall.
Aug. 28, numerous cysts in stomach wall.

This species examined on 4 other occasions in 1901 and once in 1902, when these cysts were not found.

Cynoscion regalis. Gray Trout, Squeteague, Weakfish.

Beaufort, N. C.:
1902.—Aug. 18, few cysts in stomach wall.
Aug. 19, few cysts in wall of alimentary tract.
Cysts not found in the three other examinations of this fish in 1902.
Woods Hole, Mass.:
1903.—Aug. 20, encysted in stomach wall.
1904.—July 8, small cysts on viscera.
Aug. 6, two small cysts from viscera. One of these cysts, measuring 1.8 and 1.12 millimeters in the two principal diameters, contained three blastocysts (fig. 6). The blastocysts were actively contracting and extending themselves, and the bothria of the scoleces were also active. The walls of the cyst were transparent.
1905.—July 8, one. One cyst in stomach wall.
July 14, one. Few cysts in stomach wall.
July 17, six. Few cysts in stomach wall.
July 19, ten. Cysts on mesentery.

Associated with cysts of *Tetrarhynchus bisulcatus.*

Diplodus sargus. Bream.

Bermuda:

1903.—July 14, two cysts in mass of brown pigment on serous coat of viscera.

This fish examined on 5 other occasions and the parasite not found.

Galeichthys milberti. Fork-tailed Catfish.

Beaufort, N. C.:

1901.—July 8, numerous cysts under serous coat of stomach and intestine. Dimensions in millimeters: length of cyst, 2.5; blastocyst, length, 1; breadth, 0.3; numerous calcareous bodies in parenchyma, the largest 0.08, and 0.11 in the two principal diameters; then, with almost no intermediate sizes, more numerous and smaller ones 0.015 and less in diameter.

Aug. 5, one cyst.

Examinations of this fish made on 7 other occasions in 1901 and on 2 in 1902; this parasite not noted.

Lagodon rhomboides. Pinfish.

Beaufort, N. C.:

1901.—Aug. 21, one cyst from viscera.

Pinfish examined on 12 other occasions in 1901 and on 10 in 1902 and this parasite not found.

Micropogon undulatus. Croaker.

Beaufort, N. C.:

1901.—Aug. 6, few cysts found in a cluster of cysts of the genus *Rhynchobothrium* in mesentery.

1902.—Aug. 11, one.

These cysts not noted on the other occasions of examining this fish, which were 15 in 1901 and 12 in 1902.

Ocyurus chrysurus. Yelting.

Bermuda:

1903.—July 22, few small cysts in mesentery.

No cysts found on the 2 other occasions of examining this fish.

Opsanus tau. Toadfish.

Beaufort, N. C.:

1901.—Aug. 30, few cysts on viscera.

Examinations of this fish made on 19 other occasions in 1901 and on 23 in 1902; this parasite not noted.

Orthopristis chrysopterus. Hogfish.

Beaufort, N. C.:

1901.—Aug. 6, one cyst, 2 millimeters in diameter, with two blastocysts containing scoleces on viscera.

This fish examined on 15 different dates in 1901 and on 25 in 1902; this parasite found on only one occasion.

Paralichthys albiguttus. Mud Flounder.

Beaufort, N. C.:

1901.—Aug. 21, cysts very numerous in stomach wall.

This flounder examined on 14 different dates in 1901 and on 17 in 1902. These cysts recorded on one occasion only.

Pomatomus saltatrix. Bluefish.

Beaufort, N. C.:
1901.—July 30, cysts in stomach wall.
Aug. 28, numerous cysts in stomach wall.

None found in the 9 other examinations of this fish made in 1901, nor in the 14 made in 1902.

Poronotus triacanthus. Butterfish.

Woods Hole, Mass.:
1899.—Aug. 26.
1900.—Aug. 17.
1904.—Aug. 8, 13, 17, 18, 24, 26.
1905 and 1906.—See page 120 for details.
Nomans Land, Mass.:
1904.—Aug. 30.
Montauk, Long Island:
1904.—Sept. 20.
Barnegat, N. J.:
1904.—Oct. 12.

Large numbers of cysts in flesh found on each occasion.

Scoliodon terræ-novæ. Sharp-nosed Shark.

Beaufort, N. C.:
1902.—July 11, numerous cysts in stomach wall between muscular coat and submucosa. Many of the cysts were filled with degenerate tissue.

Scomberomerus regalis. Cero.

Beaufort, N. C., 1901.—Aug. 23, enormous numbers of cysts in stomach and intestinal walls, for the most part in the submucosa. Some of the cysts were amber-colored, owing to the waxy degenerate tissue with which they were filled; some contained blastocysts in which scoleces had not yet developed far enough to be identifiable, while others contained scoleces which could be identified through the transparent walls. Dimensions, life, under pressure, in millimeters: length of cyst 1, shorter diameter, 0.8; length of larva, 0.32; bothria, length 0.16, breadth 0.12. An amber-colored, thick-walled cyst measured 1.54 and 1.09 in the two principal diameters; the blastocyst was 0.52 long and 0.28 broad, and the length of the larva was 0.28.

Trichiurus lepturus. Cutlass-fish.

Woods Hole, Mass., 1903.—July 6, several clusters of small cysts from body cavity, collected by Vinal N. Edwards. Some of the cysts were pedicelled; black pigment associated with some. These cysts were evidently from the mesentery or serous covering of the viscera. Dimensions in glycerin, compressed, in millimeters: cyst, 1.35 by 0.9; blastocyst, 0.75 by 0.63; larva, length 0.37; breadth of head, 0.22.

Xiphias gladius. Swordfish.

Woods Hole, Mass., 1904.—July 15, a few small cysts from the serous coat of the pyloric cœca, associated with small waxy cysts. Dimensions in millimeters: blastocyst, length 1.6, breadth 1; larva, length 0.67; length of head and neck, 0.60; breadth of head 0.21, of neck at base 0.16.

Mustelus canis. Dog Shark.

Woods Hole, Mass., 1905.—July 31, two sharks examined. Cysts were found in the stomach wall, many in one, few in the other.

Sarda sarda. Bonito.

Woods Hole, Mass., 1905.—July 24, five fish examined. July 27, one fish examined. Numerous cysts were found in the stomach wall of two, and few in each of the others.

Alutera schœpfi. Filefish.

Woods Hole, Mass., 1905.—Aug. 7, one. Cysts in walls of stomach and intestine. Associated with cysts containing a larval *Dibothrium*.

Paralichthys dentatus. Summer Flounder.

Woods Hole, Mass., 1905.—Aug. 18, two. Cysts found in stomach wall and in mesentery, associated with cysts of *Tetrarhynchus bisulcatus*.

EFFECT OF THE PRESENCE OF CYSTS ON WEIGHT OF HOST.

In order to ascertain how much, if any, the weight of fish was affected by the presence of cysts in the flesh, the following weights were obtained of fish belonging to the lot which was examined on August 26, 1904.

1. Three fish were chosen with care so as to agree with three others of equal length and depth. The length of these fish was 215, 215, and 200 millimeters, respectively. Three of these fish, each of which had very numerous cysts in the flesh, together weighed 672 grams; three others of similar dimensions, but with relatively few parasites, weighed 686 grams.

2. Another lot of three fish, each 200 millimeters in length, each with very numerous cysts in the flesh, together weighed 644 grams; three others chosen so as to agree in length and depth with them, but with less numerous parasites, weighed 658 grams.

3. Three fish measuring 190, 200, and 210 millimeters, respectively, each with very numerous cysts in the flesh, together weighed 630 grams; three others of the same lengths and corresponding depths, but with very few (12, more or less) cysts in the flesh, together weighed 700 grams.

4. Three measuring 150, 162, and 146 millimeters, respectively, each with many parasites, together weighed 280 grams; three others of similar length and depth with but very few (less than 12 seen) cysts, together weighed 294 grams.

Table Showing Effect of the Presence of Cysts in the Flesh on Weight of Fish, Made by Comparing Fish of the Same Length and Depth.

	Length of fish.	Condition.	Weight of the lot of three in grams.	Approximate loss.
	mm.			*Per cent.*
1	215, 215, 200	Cysts very numerous	672	2
	215, 215, 200	Cysts relatively few	686	
2	200, 200, 200	Cysts very numerous	644	2.1
	200, 200, 200	Cysts less numerous	658	
3	190, 200, 210	Cysts very numerous	630	10
	190, 200, 210	Cysts very few	700	
4	146, 150, 162	Many cysts	280	4.8
	146, 150, 162	Very few cysts	294	

It is a significant fact that in all cases where a comparison was made between fish of the same length and depth, the one with numerous parasites and the other with few, the result was a less weight for the fish having the greater number of parasites. It seems reasonable to conclude, therefore, from this loss of weight, that the vitality of the fish is affected by the presence of cysts in the flesh.

LIFE HISTORY OF THE PARASITE.

The round of life of this parasite may be epitomized thus:

The adult stage is passed in the spiral valve of some shark. Ripe proglottides containing large numbers of eggs escape from the intestine of the shark along with the feces, and are eaten by various fishes. The eggs give rise to embryos, which make their way into the body of the intermediate host, where they become encysted. The encysted embryo ultimately develops into a scolex with characteristic sucking disks and proboscides armed with hooks. When a fish that has these cysts in its tissues is swallowed by a shark which is adapted to become the final host of this tapeworm the connective tissue cyst is digested off, the scolex is liberated, and attaches itself to the mucous membrane of the shark's intestine. It there grows to the adult tapeworm, producing segments which separate easily from the strobile as they ripen, and pass off with the feces bearing eggs to begin another generation.

SPECIAL CASE OF BUTTERFISH AND HAMMERHEAD SHARK.

Food of the hammerhead shark.—A more particular consideration of the case afforded by the butterfish is justified by the high percentage of fish which were found to be infected. That the butterfish is the principal source from which the adult tapeworm of the hammerhead comes is based on the following considerations:

The hammerhead is carnivorous; fish and squid are the only food which I have found in the stomachs of those which I have examined. Butterfish are abundant, and, being good eating, are doubtless often eaten by the hammerhead.

Practically all of the butterfish which were examined for cysts in the flesh, except small specimens, were found to be infested, and a large proportion of them harbored enormous numbers of cysts. Although special search for these cysts was confined to the past season, there is reason for believing that the large proportion of parasitized fish then found is not exceptional. My notes made at the time of collecting in 1899 and 1900 show the same distribution of cysts in the flesh of this fish as was found in 1904, and there is no reason for thinking that they would not have been found in abundance in other butterfish in previous years if search had been made for them.

Sharks and butterfish are taken together in the fish traps, thus showing an association in their natural surroundings sufficiently close to permit their being final and intermediate host, respectively, of the same cestode parasite.

In view, therefore, of the very large proportion of butterfish which harbor cysts of *Otobothrium crenacolle*, the conclusion is justified that the butterfish is the principal source from which the supply of adult tapeworms is kept up.

It may be mentioned here for the comfort of eaters of fish that parasites in the flesh of food-fish are of very unusual occurrence. I had looked for them repeatedly in most of the food-fish of the Woods Hole region for many years without finding any, but had never happened to examine the flesh of the butterfish. Even those butterfish with cysts in the flesh which were brought to my attention did not at first suggest anything to me other than that they were cases of exceptional and accidental infection.

Food of the butterfish.—Turning now to the other phase of the subject, it may be inquired, What is the source of the cysts in the flesh of the butterfish?

Any persistent and regularly recurring case of parasitism when a cestode is the parasite is usually possible only where the final and intermediate hosts are related to each other as eater and eaten. Furthermore, they must be so closely associated in habitat that the intermediate host in the natural performance of its feeding activities will become infected. In the absence of opportunities to study the habits of the butterfish in its natural surroundings recourse must be had to an examination of the stomach contents in order to ascertain the nature of the food, since it is with the food that cestode eggs and embryos gain admission to the body of the intermediate host.

The following notes on the food of the butterfish were published in my report, "Parasites of Fishes of the Woods Hole Region" (Bull. U. S. Fish Commission, 1899, vol. XIX, p. 453):

> Stomachs of larger fish usually empty, but a few fragments of fish occasionally seen. In the alimentary tracts of smaller specimens copepods, annelids, and small fish were found. Sept. 1, 1900, 25 small fish were examined. The food consisted principally of amphipods.

In the latter part of August, 1903, a few butterfish were examined on three occasions by my assistant, Mr. G. F. Englesby. The stomachs were empty in two of the lots; in the other fragments of fish were found. In July and August, 1904, butterfish were examined on several occasions by my assistant, Mr. M. B. Swift. In most cases the stomachs were reported to be empty. In a few cases I examined the digested material with the aid of a microscope and found the setæ and jaws of annelids. Pieces of green algæ were found on two occasions. Mr. Vinal N. Edwards examined butterfish on October 7, 9, and 16 and found ctenophores in the stomachs on each of these dates and annelids on the 9th. On May 10 he found shrimp. Mr. Edwards states that the butterfish does not take the hook, but is caught only in traps.

It is evident, I think, even from the above rather meager food notes, that the butterfish eats any small floating or swimming animals which it encounters in the water.

It should be remembered also that the chyle in the intestines of those hammerheads in which *Otobothrium crenacolle* was found in considerable numbers contained large numbers of ripe segments of this tapeworm, which, moreover, continued active for many hours in sea water. Also the segments contained enormous numbers of eggs. It follows from this condition of things that segments containing eggs with embryos are being continually discharged into the water along with the feces from those sharks which harbor this worm in the intestine. Butterfish encountering these free segments would naturally catch and swallow them, as they would any small swimming worm, crustacean, or the like. This is also indicated by the fact that those butterfish which were found to be infected in most cases carried large numbers of the cysts, which would not be the case if infection came only from the accidental swallowing of eggs which had escaped from the segment and become disseminated through the water. The evidence thus becomes strong enough to fasten upon the butterfish, with a high degree of probability, the reputation of habitually seeking these cestode segments where they are most likely to be found, viz, in the feces of the hammmerhead shark.

ECONOMIC CONSIDERATIONS.

It has been asked, What is the effect of the presence of this flesh parasite on the value of the butterfish as a food fish?

So far as the writer's knowledge goes, no very satisfactory answer can yet be made to this question. It will require observations extending over several years to ascertain whether the large proportion of butterfish found to be infected in the summers of 1904, 1905, and 1906 is normal or exceptional. If the number of butterfish on the coast remains fairly constant year after year and sharks are migratory, so that while there are large numbers one season there are few another, this would undoubtedly have an effect on the degree of parasitism in the butterfish in successive years.

It is not likely that the parasites themselves have any effect on the nutritive value of the flesh in which they are encysted, neither could their presence be detected by the palate. That they work some disadvantage to the vitality of the fish is shown by the results given above of the experiments in comparative weights. I am not aware that the eating of butterfish has been followed by any after effects which may not be experienced from the eating of any fish. Neither has it been shown that the presence of these cysts in the flesh is accompanied with toxic products of any kind. Of course there is no danger whatever that these cysts can give rise to adult tapeworms in warm-blooded man, even if he were in the habit of eating fish which were only partly cooked, or even uncooked.

The principal objection which can be made against the use, as food, of fish in which cestode cysts are probably present is the very natural one which is based on the popular prejudice against measly meat of any kind. This prejudice is not only natural but doubtless rests on deep-seated racial experience. A recent communication from Mr. M. B. Swift furnishes a good illustration of this prejudice, as well as a confirmation of the unblissful state of the knowing.

At his boarding place, a short time ago, butterfish were served, and he, after surreptitiously inspecting the fish and finding in them the familiar cysts in large numbers, decided that he would not take fish that day; but he neglected to state his reason until after his table companions had partaken freely of the fish. He then generously imparted to them his knowledge and demonstrated his lecture by showing to his attentive audience the real presence of the subject of his discourse. The result was immediate, startling, and in two cases disastrous to the intended destination of the breakfast.

Again, since we have here a food fish which apparently is almost invariably infested with tapeworm cysts in the flesh, and often in great numbers, it is natural that inquiry should be made for some remedy for this affliction under which a particular part of creation is groaning. Just how far man's interference with the balance of nature in his search for food among the fishes of the sea enters as a factor tending toward the extinction of any species is hard to estimate. Theoretically his mightiest efforts are, in the aggregate, so slight that they appear to my mind to be a negligible quantity. If the economic use of fish by man does enter as an appreciable factor in the struggle for existence, then anything which will open up uses to which sharks may be put will be in the way of restoring the balance which has been disturbed and of correcting this particular evil of cestode parasites in the flesh of food fish.

The skin of the shark has some commercial value as shagreen, glue may be made of some of the waste parts, oil from the liver, etc. In addition to these uses the use of sharks as food is a matter of considerable economic importance. Young sharks are quite as good eating as many of the fish which are sold in our markets and, indeed, they themselves form an important addition to the food fishes in some countries. Unfortunately there is a strong prejudice against shark meat, especially in this country, and when it is called dogfish the prejudice is intensified, although dogfish, in the opinion of many who have tried it, is quite as good eating as squeteague. Properly prepared it would be hard to tell it from canned salmon. It must be admitted, however, that old shark is not good eating.

If, then, an industry could be built up which would make it worth while for fishermen to expend the same energy and develop the same ingenuity in the capture of sharks as is done in the capture of fish which are now used as food, there would result a means of profit where there is now actual loss. A factor would also be introduced in the life experience of sharks which might tend toward reducing their numbers. If the number of sharks were reduced there would follow a corresponding reduction in the amount of such parasitism among teliosts as is caused by cestode worms.

PROBLEMS SUGGESTED.

A few problems are suggested by the occurrence of these parasites in the flesh of the butterfish for which no final solutions are proposed in this paper.

1. Time required for the development of a mature scolex.

It is possible that this may be ascertainable by means of feeding experiments, although there are many practical difficulties in the way. Some information is probably obtainable by a very careful examination with the aid of the microscope of small butterfish of known age. Small fish were found to be free from cysts in the flesh, or to have very few and those immature. The larger fish were for the most part found to have many parasites. Furthermore, the cysts in the smaller fish were white, those from the larger fish yellowish, showing thus a difference in age.

2. Distribution of the cysts in the flesh.

The rather uniform distribution of cysts in certain favored locations is doubtless dependent primarily on the vascular system, and particularly on the arterial circulation.

When liberated from the egg shells by the action of the digestive juices the embryos are very small and, upon penetrating the mucous membrane of the stomach and intestine and entering lymph spaces or capillaries, would be carried in the circulation as easily as blood corpuscles. The distribution of the cysts indicates that the embryos have entered the circulation by way of the intestino-portal vessels and have been carried to the heart, thence through the capillaries of the gills, and have, for the most part, reached their final resting place by way of the dorsal aorta and its continuation in the caudal aorta. As the blood current is checked in the small arterial branches and capillaries the embryos make their way into the adjacent muscular and connective tissue.

3. Susceptibility of the butterfish to the encystment of *O. crenacolle* in the flesh, and immunity of other fish from the same.

It is possible that a comparative study of the circulation and the splanchnic anatomy of the butterfish and one of the species of fish in which cysts were found in large numbers on and in the abdominal viscera may yield data for the solution of this problem.

EXPLANATION OF PLATES.

KEY TO LETTERING.

b, bothrium.
bl, blastocyst (plerocercus).
c, cyst.
ca, calcareous body.
cb, contractile bulb of proboscis.
ct, connective tissue.
m, muscle tissue.
o, accessory bothrial organ.
p, proboscis.
sc, scolex or larva.
sh, proboscis sheath.
st, beginning of strobile.

PLATE I.

FIG. 1. Specimen of butterfish (*Poronotus triacanthus*) laid open to show cysts of *Otobothrium crenacolle*. The principal regions of infection are shown somewhat diagramatically. The number of cysts shown in the sketch is far less than may be seen in a badly parasitized fish. Sketch made from a fish 22 centimeters in length, from Barnegat, N. J.

FIG. 2. From life. Cluster of cysts from the butterfish. The cluster measured 2.1 by 1.2 millimeters in the two principal diameters. The scoleces were active, their average length about 1 millimeter.

FIG. 3. A blastocyst from cluster shown in figure 2, compressed so as to show the distinctive features of the species; length of larva 0.8 millimeter.

FIG. 4. Another cyst from same host. The blastocyst, which does not completely fill the cyst, measured 1.24 by 0.8 millimeter in the two diameters.

FIG. 5. Blastocyst of figure 4 removed from the cyst. The head and part of the neck of the scolex is emerging from the blastocyst and the proboscides are everted.

FIG. 6. Cyst with three blastocysts containing scoleces, from serous coat of intestine of squeteague (*Cynoscion regalis*). The walls of the cyst were transparent; blastocysts and scoleces active. Cyst 1.8 by 1.12 millimeters in the two diameters.

PLATE II.

FIG. 7. Cyst, blastocyst, and scolex from butterfish, life. Diameter of cyst, 0.5 millimeter.

FIG. 8. Blastocyst with scolex emerging—removed from cyst shown in figure 7.

FIG. 9. Scolex (larva) removed from blastocyst.

FIG. 10. Part of bothrium highly magnified, showing the accessory organs retracted.

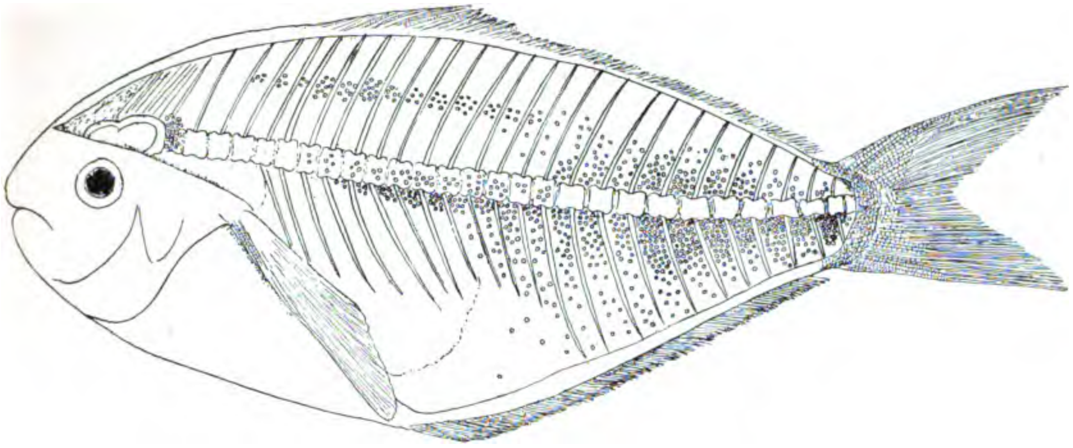
FIG. 11. One of the accessory organs, everted, still more highly magnified.

FIG. 12–16. Different views of proboscides highly magnified. Figures 12 and 13 are views of portions of the proboscis near the base. The sketches were made with the aid of a camera lucida, 1-inch eyepiece and one-twelfth objective, and represent an enlargement of about 720 diameters.

FIG. 17. Cyst, blastocyst, with scolex and muscle tissue of host, compressed; sketched from specimen mounted in balsam, × about 60.

FIG. 18. Section of muscle tissue with fifteen cysts, × about 6. The muscle fibers are cut transversely in the upper and longitudinally in the lower part of the figure.

FIG. 19. Section of muscle tissue with ten cysts, × about 60. *a*, empty cysts; blastocysts with larvæ appear in other sections of the series; *d*, neck of scolex cut transversely, showing the four proboscides; *e*, scolex cut nearly longitudinally; *f*, bothria cut nearly transversely; *g*, section passes through the bothria and two of the contractile bulbs nearly longitudinally; the neck of the larva has been bent and is largely missing from this section; *h*, diagonal section of neck of larva—at one end of section the proboscides are cut transversely, at the other two of them appear but cut longitudinally; *i*, section shows blastocyst but misses the larva, which may be seen in another section of the series.



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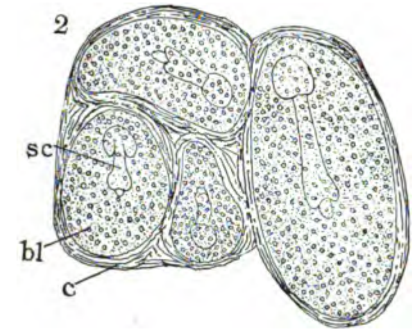

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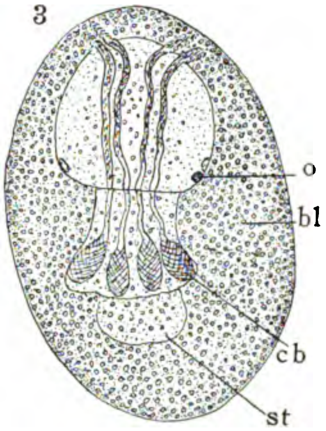

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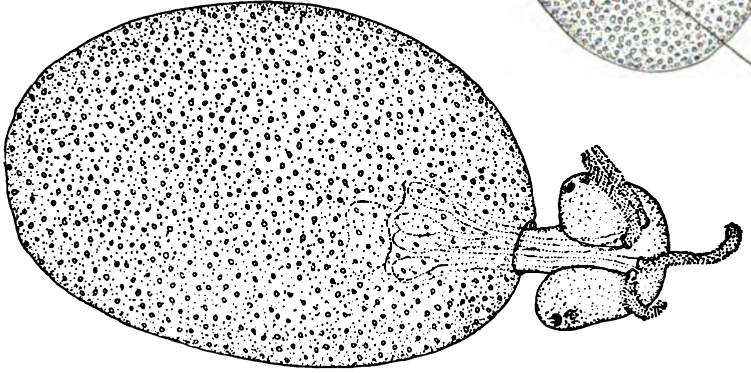

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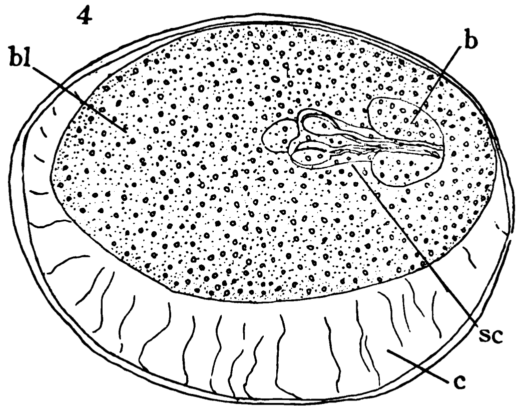

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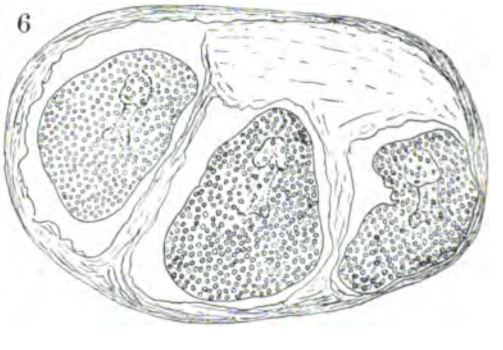

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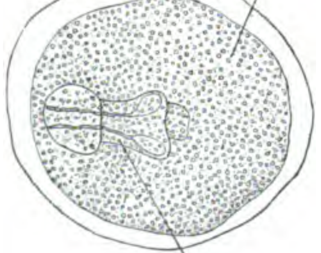
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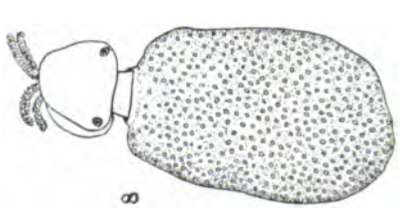
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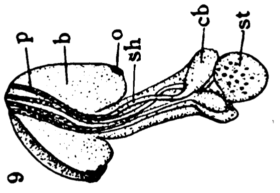
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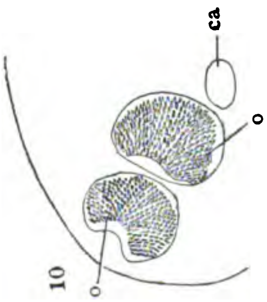
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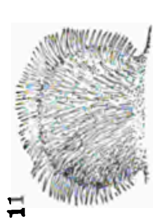
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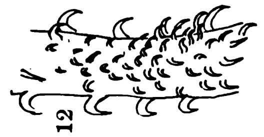
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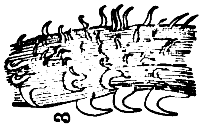
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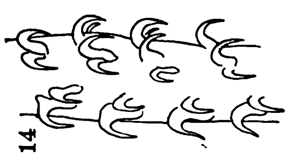
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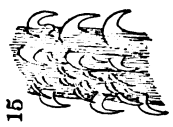
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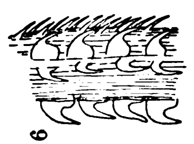
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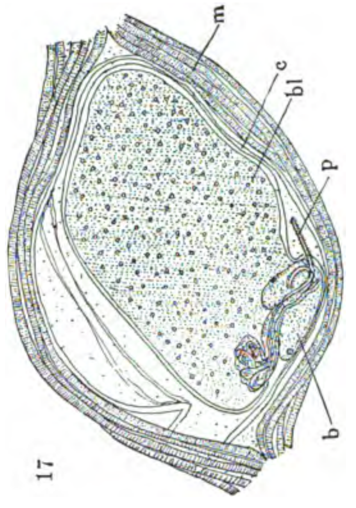
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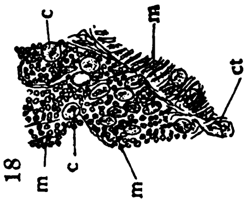
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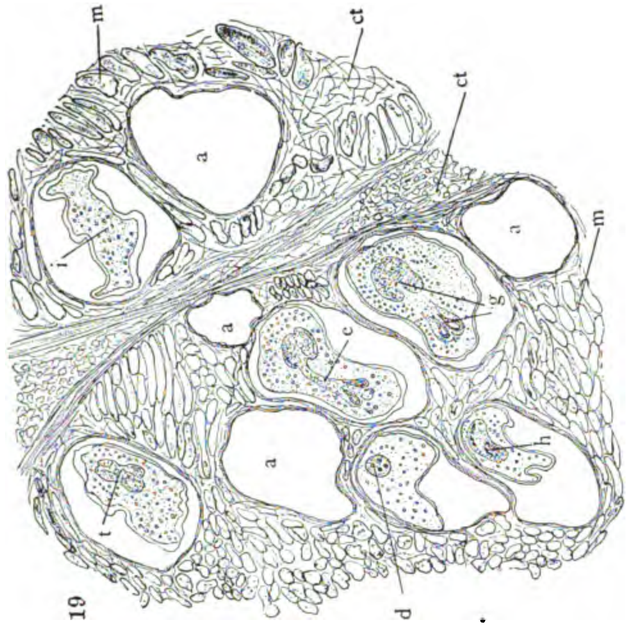
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NOTES ON LAKE TAHOE, ITS TROUT AND TROUT-FISHING.

By CHANCEY JUDAY,

Wisconsin Geological and Natural History Survey.

BUREAU OF FISHERIES DOCUMENT NO. 615.

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NOTES ON LAKE TAHOE, ITS TROUT AND TROUT-FISHING.

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INTRODUCTION.

Lake Tahoe is one of the largest as well as one of the most picturesque American mountain lakes. From a scientific standpoint, it is also a most interesting body of water, but the study of it has been very much neglected, and comparatively little is known of its physical and biological aspects. Muir has given some delightful sketches of the beauties of the lake and the surrounding country. Le Conte spent a short time there in the fall of 1873, making some physical investigations, the results of which he published ten years later. In 1878 Gill and Jordan described some of the fishes of the lake. In 1889 the United States Geological Survey made a survey to determine the possibilities of the basin as a storage reservoir for irrigation purposes and has since published topographical maps of the region based on surveys made in 1889. Russell, in his "Lakes of North America," has given a brief but excellent description of Lake Tahoe. In 1902 Price issued an admirable little "Guide to the Lake Tahoe Region," in which the more important physical and biological features of the region are pointed out and briefly described. Early in 1904 Treat described the angling methods employed by the fishermen as well as some of his own experiences on the lake as an angler. Ward has recently published a report on some investigations which he made in this region during the summer of 1903. Such, in brief, is the accessible literature pertaining to the physical and biological features of Lake Tahoe and vicinity. (See p. 146 for references in full.)

During the summer of 1904, this interesting region was visited by the writer in order to make some investigations for the United States Bureau of Fisheries. The investigations were limited to Lake Tahoe, with the exception of a day spent in making a cursory examination of some of the small lakes lying to the southward, in the vicinity of Glen Alpine. They covered but a brief period of time, June 17 to July 6. Their chief object was to obtain as much information as possible concerning the methods employed by the fishermen in catching the trout, and the amount and value of the catch.[a]

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[a] I am indebted to Wells Fargo & Co., and Mr. S. D. Brastow, superintendent of their western division; to Mr. Charles A. Vogelsang, chief deputy of the California fish commission; to Mr. E. W. Hunt, in charge of the two state hatcheries located on the lake; to Mr. William Boyle and to Prof. W. W. Price; likewise to various residents of the region, fishermen, and others, for information, assistance, and numerous courtesies.

DESCRIPTION OF LAKE TAHOE.

Location, size, and physical features.—Lake Tahoe is situated in eastern California and western Nevada. The boundary line between these two states passes through it in a north and south direction, only a short distance west of the eastern shore, so that more than two-thirds of the area of the lake lies in California and less than one-third in Nevada. The thirty-ninth parallel of latitude crosses the southern end. To quote from Le Conte (1883, p. 506):

> This lake, the largest and most remarkable of the mountain lakes of the Sierra Nevada, occupies an elevated valley at a point where this mountain system divides into two ranges. It is, as it were, ingulfed between two lofty ridges, one lying to the east and the other to the west. As the crest of the principal range of the Sierra runs near the western margin of this lake, this valley is thrown on the eastern slope of this great mountain system.

The greatest dimension of the lake is in a north-south direction, and is said to be about 22.5 miles; its greatest width is about 13 miles, and it has an area of about 195 square miles. The tributary watershed has an area of more than 300 square miles exclusive of the area of the lake, the whole basin having an area of a little more than 500 square miles. The altitude of the lake is 6,225 feet and the greatest depth found by Le Conte was 1,645 feet (501 meters).

Affluents.—Le Conte further says:

> Probably more than a hundred affluents of various capacities, deriving their waters from the amphitheater of snow-clad mountains which rise on all sides from 3,000 to 4,000 feet above its surface, contribute their quota to supply the lake. The largest of these affluents is the upper Truckee River, which falls into its southern extremity. The only outlet to the lake is the Truckee River, which carries the surplus waters from a point on its northwestern shore out through a magnificent mountain gorge, thence northeast, through the plains of Nevada, into Pyramid Lake (and Winnemucca Lake). This river in its tortuous course runs a distance of over one hundred miles.

Generally a large amount of snow falls on the lakeward slopes of the surrounding mountains and thus supplies many of these affluents with water during the entire summer. Muir (1878) states that observations were made at a station on the west shore of the lake and it was found that the amount of snow, measured as it fell, was a little less than 10 feet one winter and over 47 feet another winter. On the 21st of June, 1904, vast areas were found along the upper courses of some of the affluents where the snow was from 5 feet to probably 30 feet deep. The warm summer's sun was melting this snow rapidly and by midafternoon these streams had increased enormously in size.

Variations of level.—On this subject Le Conte says (1884, p. 41):

> As might be expected, the waters of Lake Tahoe are subject to fluctuations of level, depending upon the variable supplies furnished by its numerous affluents. In midwinter, when these streams are bound in icy fetters, the level falls; while in the months of May and June, when the snows of the amphitheater of mountain slopes are melting most rapidly, the level of the lake rises and a maximum amount of water escapes through its outlet. According to the observations of Capt. John McKinney, made at his residence on the western shore of the lake, the average seasonal fluctuation of level is about 0.61 meter (2 feet); but in extreme seasons it sometimes amounts to 1.37 meters (4.5 feet).

As a dam several feet in height is now maintained at the outlet, the fluctuations at present may be greater than those recorded above. According to Mr. Murphy, who has lived many years on the shores of the lake, the water was about 3 feet higher than usual in June, 1904, and was the highest since 1861. Powell records a fluctuation of 5.5 feet (1891, p. 171).

Origin of the lake.—In discussing the origin of Lake Tahoe, Le Conte states that it is highly improbable that the basin was scooped out by glacial agencies; that, rather, the lake was once wholly occupied by ice, a huge mer de glace. He is inclined to the belief (1884, p. 45) that—

> * * * the small lakes near the southern and southwestern margin of Lake Tahoe are really glacier-scooped rock basins, yet the position of the principal lake, countersunk between two ridges of the Sierra Nevada, seems to render it probable that its basin may, in reality, be a "plication-hollow" or a trough produced by the formation of two parallel mountain ridges and afterwards modified by glacial agency—that it is, in fact, a feature of mountain formation and not of glacial sculpture.

Temperature.—No attempt was made to obtain the temperature of the water at any considerable depth; that is, beyond a depth of 425 feet. The following table shows the results obtained by Le Conte (1883, p. 509) and those obtained in this investigation:

Depth.	Temperature.		Depth.	Temperature.	
	Aug., 1873.	June, 1904.		Aug., 1873.	June, 1904.
Feet.	° *F.*	° *F.*	*Feet.*	° *F.*	° *F.*
0	67	60.75	300	46	41.25
25	....	57	330	45.5 B	....
50	63	55.25	400	45	40.8
75	....	54.75	425	....	40.8 B
100	55	49.75	480	44.5 B	....
125	....	46	500	44	....
150	50	....	600	43	....
200	48	41.75	772	41 B	....
250	47	....	1,506	39.2 B	....

The letter B indicates bottom temperatures. Le Conte states that he obtained the same general results in all parts of the lake and that his table is an abstract of his average results. It will be noted that he obtained higher temperatures than those obtained by me. This may be accounted for chiefly by the fact that his observations were made between the 11th and 18th of August, or about the time the water had reached its maximum temperature for the summer, while mine were made on June 27, or before the water of the lake had been exposed very long to the warming influence of the summer's sun. The temperature of the water in three of the creeks was as follows: Blackwood Creek, 50° F.; McKinney Creek, 46.5°; Taylor Creek, 55.75°.

There are some thermal springs at the northern end of the lake, one of which, at Brockway, had a temperature of 130° F. The temperature of this water as it came from the ground was probably somewhat higher, for this reading was made in a large basin about 5 feet in diameter and several feet deep, and the warm water entered the bottom of the basin. This thermal spring is one of the attractive features of the resort, as its water is palatable and is also utilized for bathing purposes. Le Conte records a temperature of 131° F. for some of these thermal springs.

The temperature of the air probably remains several degrees below the freezing point for a considerable period of time each winter, yet ice never forms on the lake except in shallow, detached bays. "The true explanation of the phenomenon may, doubtless, be found in the high specific heat of water, the great depth of the lake, and in the agitation of its waters by the strong winds of winter." (Le Conte, 1883, p. 511.)

Transparency.—Lake Tahoe is noted for its clear, transparent water. On calm, sunny days, objects could be distinctly seen on the bottom where the water was 50 feet deep. In fact, these objects were so plainly visible that the water did not appear to have a depth of more than 10 or 15 feet. A Secchi's disk, 5 inches in diameter, just disappeared from view at a depth of 65 feet. Le Conte (1883, p. 512) found the water much more transparent, however, as he says that a dinner plate 9.5 inches in diameter was plainly visible at a depth of 108 feet. The lower degree of transparency found by me was probably due to the fact that my observations were made during the flood season. All the affluents were filled to overflowing and had been for some time previous to this. These swollen streams were invariably more or less roily, and at the mouths of the larger ones the sediment-bearing water could be traced into the lake for some distance.

One of the most striking features of the lake is the great diversity of color exhibited by the water. "It appears that under various conditions—such as depth, purity, state of sky, and color of the bottom—the waters of this lake manifest nearly all the chromatic tints presented in the solar spectrum between greenish yellow and the darkest ultramarine blue, bordering upon blue black." (Le Conte, 1883, p. 596).

Aquatic vegetation.—The larger forms of aquatic plants were found to be comparatively scarce. Most of the shore of the lake is of such a nature that it is difficult for them to obtain a foothold. In the more favorable locations such forms as *Scirpus*, *Batrachium*, *Potamogeton*, *Carex*, and *Nitella* were found.

The plankton.—A few plankton hauls were made June 27, 1904, on the west side of the lake, about 2 miles south of Tahoe Tavern, where the water reaches a depth of about 400 feet. A comparatively small quantity of plankton was found; the lake would probably be classed as plankton-poor. The phytoplankton was relatively small in amount and consisted of diatoms and filamentous algæ.

Only one species of rotifer was noted, *Notholca longispina* Kellicott. It was found in very limited numbers.

Copepoda made up at least three-quarters of the bulk of the plankton. The limnetic members of this group were *Epischura nevadensis* Lilljeborg and a species of *Diaptomus*. The latter was the most abundant form and constituted over half the entire quantity of plankton. *Cyclops* was not noted in any of the limnetic catches.

The Cladocera were represented in the limnetic region by two Daphnias. *Daphnia pulex* De Geer apparently belongs to the variety *pulicaria* Forbes. It differs from Forbes's description of this variety in a few minor points, the sensory hairs projecting slightly beyond the tip of the beak, and the eye being somewhat smaller and situated a short distance above the ventral margin of the head. *Daphnia hyalina* Leydig seems to agree most closely with Burckhardt's variety *richardi*. The head is small, contained four times in the length of the body, and its ventral contour is moderately concave. The crest is small and regularly curved. The eye is small and situated in the anterior third of the head, a short distance above the ventral margin. The spine is short.

In the littoral region, the following Cladocera were found: *Ilyocryptus acutifrons* Sars, *Eurycercus lamellatus* O. F. Müller, *Acroperus harpæ* Baird, *Alona affinis* Leydig, *Chydorus sphæricus* O. F. Müller.

Epischura and *Diaptomus* deserted the upper 5 feet of water on bright, sunny days, but both came to the surface at night. The latter was very abundant at the surface at night. *Daphnia hyalina* descended to a depth of 40 feet during the daytime, but came to the surface at night. *Daphnia pulex* descended to a depth of 50 feet in the daytime, but was found at the surface at night. The two *Daphnia* were found this near the surface in the daytime only in the shallower water, where the transparency was only about 52 feet. In the deeper water, where the transparency was greater by 13 feet, neither form was found in catches that did not reach a depth of 75 feet. Thus the diurnal migration of *D. hyalina* was at least 40 feet in the shallower, less transparent water and about 75 feet in the deeper, more transparent water, while *D. pulex* showed a daily migration of 50 to 75 feet. These migrations were greater than any noted for these forms in Wisconsin lakes or in Winona Lake, Indiana. In these instances the maximum movement of *D. hyalina* was only 22 feet and of *D. pulex* a little less than 40 feet (Juday, 1903 and 1904).

THE TROUT OF LAKE TAHOE.

Species, size, abundance, etc.—Only two kinds of trout are caught in any considerable numbers. These are *Salmo henshawi* (Gill & Jordan), which has several common names, such as Lake Tahoe trout, Truckee trout, pogy, and snipe; and also *Salmo tahoensis* (Jordan & Evermann), which is commonly called the silver trout of Lake Tahoe. Locally, the males of the former are frequently called redfish because they have copper-colored sides during the breeding season.

The Tahoe trout, or pogy, is caught chiefly along the western side of the lake and at the south end. A large area extending south a few miles from Observatory Point seems to be a good feeding ground for them, and this is the favorite fishing ground of the anglers located in the vicinity of Tahoe City. Silver trout are most abundant in the northeastern part of lake, in Crystal Bay and Sand Harbor, but a few are caught in other parts. The Tahoe trout is caught in much greater abundance than the silver trout, but it does not attain such a large size. The former rarely exceeds a weight of six pounds, while specimens of the latter have been caught which exceeded this weight by several pounds. The following measurements and weights of trout caught in Lake Tahoe are given by Treat (1904, p. 866), who does not, however, indicate the species he measured and weighed:

Length.	Weight.
Inches.	*Pounds.*
17.25	1.75
19.75	2.6
20.75	3.75
25.75	5.5
29.75	9.5

Some years ago the Mackinaw trout, *Cristivomer namaycush* (Walbaum), was introduced, and examples of it are caught occasionally in the southern part of the lake. During the season of 1903, a 10-pound trout of this species was caught in the vicinity of Glenbrook.

Breeding habits.—The Tahoe trout, or pogy, ascends the streams to spawn and begins spawning, usually, about the middle of April. Mr. E. W. Hunt stated that the trout began spawning about two weeks later than usual in 1904, and that they averaged somewhat smaller in size than in former years. He also stated that the average number of eggs obtained from each female was about 1,400. As late as August a few trout may be found spawning in some of the streams, but generally the vast majority are through by the middle of June.

Some years ago the California Fish Commission established two good hatcheries on Lake Tahoe. Each hatchery has a capacity of about a million eggs, and almost every season both are filled to their utmost capacity with the eggs of the Tahoe trout. The fry developed from these eggs are planted in Lake Tahoe itself and in the small lakes tributary to it. Many of these small lakes did not possess trout until they were stocked by the commission. The fry are usually planted about the first week in August. The large increase in the catches of trout during the past two seasons is undoubtedly due to two factors, first the activity of the California Fish Commission in keeping the lake well stocked, and second, for the past four years the beginning of the open season on June 1 instead of May 1 as formerly, so that the trout are now protected during the most important part of their spawning season.

The silver trout spawns in the lake, hence its eggs can not be obtained for the hatcheries.

Food.—Owing to the fact that the fishermen kept their trout alive several hours after catching them, it was difficult to obtain good material for a study of the food. As a result, out of a dozen stomachs of Tahoe trout that were examined, only three were found to contain material of any consequence. The other nine contained only small quantities of insect fragments that were too small to identify. Two stomachs from trout that were 16 inches long were about one-fourth full. Each contained from 50 to 75 *Daphnia* and fragments of adult *Chironomus* and chironomid pupæ. The third stomach, from a male 15 inches long, contained 4.6 cubic centimeters of *Daphnia*, a small fragment of a beetle, and a few small fragments of other insects. The number of individuals making up the 4.6 cubic centimeters of *Daphnia* was estimated. Two separate measurements were made by allowing the material to settle for 24 hours in graduated cylinders. In one case, 1.1 cubic centimeters contained 430 *Daphnia*, and in the other, 1.3 cubic centimeters contained 477 individuals. The average for these two measurements is 378 individuals per cubic centimeter, which multiplied by 4.6 gives a total of 1,739 *Daphnia.* This, however, does not represent the total destruction of *Daphnia* for this single meal, as the brood chambers of a large number of them contained either eggs or embryos. About two-thirds of the individuals were *Daphnia pulex* and the rest were *D. hyalina.* It is an interesting fact also that no Copepoda were eaten, since both *Epischura* and *Diaptomus* were much more abundant than *Daphnia.* The former are much more powerful swimmers than the latter, but this fact alone is scarcely sufficient to account for their entire absence from the menu of the trout. A difference in size does not answer the question, for *Epischura nevadensis* is a large form and could be obtained as easily, apparently, so far as size is concerned, as *Daphnia.* The three trout that had eaten *Daphnia* must have obtained them at a depth of at least 40 feet, for these crustaceans were not found any nearer the surface than this in the daytime on the feeding ground where these fish were caught.

It was pointed out above that the fishermen find it necessary to use a longer line and thus, presumably, fish deeper as the season advances. Treat (1904, p. 868) has suggested that this is due to a downward movement of the plankton, the trout following it into the depths to feed on it. He gives no data, however, in support of his suggestion. Neither did my own observations extend over a sufficient period of time to determine whether the *Daphnia* do descend to greater depths in the daytime as the season advances. It is not at all unlikely that they do, for the water becomes warmer and it undoubtedly becomes more transparent, and both of these factors would tend to cause the descent to greater depths. But even if such a seasonal depth migration of *Daphnia* does occur, it would scarcely follow necessarily that the trout move down also because of this fact, for they are not entirely dependent on plankton crustacea for their food. In fact, the above records seem to indicate that these crustacea form only a minor part of the food in most cases, while insects form the major part at this season of the year. So it seems probable that other factors are involved, which can be determined only by observations covering a much longer period of time. Jordan and Henshaw (p. 198) state that the wonderful transparency of the water renders the use of a long line imperative, as the trout are too shy to be trolled in very near the boat. Thus the increase in the transparency of the water after the flood season of the streams is over may, in part, account for the increased length of line necessary for successful fishing late in the season.

The stomach of a 10-inch Tahoe trout which was caught in Fallen Leaf Lake, a small lake just south of Lake Tahoe, contained elytra of two beetles and fragments of 25 or 30 ants. Three Tahoe trout, each 7 inches long, were obtained from Grass Lake, a small lake still farther south, and their stomach contents were as follows: No. 1, 32 damsel-fly nymphs; No. 2, 6 damsel-fly nymphs, 4 water tigers (larval Dytiscidæ), and many chironomid larvæ; No. 3, 4 water tigers and many chironomid larvæ.

It is interesting to note in this connection that in these small lakes the Tahoe trout or pogy readily rises to the fly.

TROUT FISHING IN LAKE TAHOE.

Angling.—All of the fishing in Lake Tahoe is done by angling. Fishermen located at several points around the lake were visited and interviewed, and their methods and fishing gear were examined. The method which is almost universally employed at the present time differs but little from that described by Jordan and Henshaw in 1878 (p. 198), so that, to use Treat's appropriate expression, "it may fairly be said to have been born of experience" (1904, pp. 864–866).

> Years of experience in trolling on Lake Tahoe have resulted in the adoption of the device now employed—a metal, egg-shaped spoon of generous dimensions, of burnished copper or nickel plated, according to the whim of the fisherman. Brass turnbuckles are attached to either end of this spoon. A snell and hook is fastened to the smaller end while a twisted copper wire 75 to 125 feet in length leads to the 20 feet of cotton line in the hand of the fisherman. The hook, a large-sized Pennel, Limerick, or Sproat for choice, is baited with worms or minnows. This gear is trolled from the rear of the boat, the line being continuously moved back and forth, the latter movement being made more quickly than the former so as to insure the proper spinning of the spoon. When the fish is hooked he is pulled in by main strength.

The hook is usually put about 3 feet from the large spoon and sometimes a small spinner is attached just above the hook. About the only change that is made in this gear is the substitution of a "squid" spoon for the regular one. This is a large oval spoon with a large hook attached directly to one end and with a swivel at the other end for attachment to the line. Some of the fishermen consider this spoon better for large trout than the regular one.

The wire line is made of 4 to 12 strands of fine copper wire, the number of strands depending on the size of the small wire used. For convenience in handling, the line is wound upon a hand reel, which usually has a drum 5 inches or more in diameter. Wire line is used in preference to any other, because it helps to sink the spoon, and the fishermen have learned from experience that the hook must be trolled at a considerable depth. The open season extends from June 1 to November 1. Early in June the fishermen use a line 50 to 75 feet long, but as the season advances more and more line must be used, so that by September or October a line 200 feet long is sometimes used.

Some years ago still-fishing was indulged in by amateurs, but this method is no longer employed.

Minnows are the standard bait, although many angleworms are used. When the trout are not readily tempted by these two kinds of bait, the fishermen resort to grubs, dobsons, and caddis-fly larvæ. Formerly, canned clams were frequently used in still-fishing.

Most of the trout are caught along the edge of deep water—that is, where the water rapidly descends from a depth of 50 or 60 feet to a depth of 200 feet or more. The best results are obtained by rowing the boat alternately from shallow to deep water and back again, in a zigzag course, along such a slope. Sometimes trout are caught where the water is only a few feet deep, but this is a rare occurrence. Occasionally, also, they will rise to a fly, but in general rod and fly fishing are not a success. Deep fishing with the regular "jerk" line yields much better results.

Shipments of trout.—It is impossible to say, of course, just how may pounds of trout are taken from Lake Tahoe in a season, for anglers are numerous and they are not particularly interested in keeping records of their catches. But a general idea of the results of the fishing done on the lake may be obtained from the following table, which shows the number of pounds of trout shipped from the lake during the past five seasons:

Season.	Trout shipped.
	Pounds
1900	58,667
1901	11,981
1902	7,982
1903	13,977
1904	22,780

The record for 1901 does not include the shipments from Tahoe City, as no data were received from this office concerning its shipments in that year. So far as these statistics go, 1900 was the banner season. This was followed by an unusually small shipment in 1901 and a still smaller one in 1902, the shipment of the latter year being only about one-seventh of that in 1900. There were marked improvements in 1903 and 1904, but even the shipment in 1904 reached scarcely more than a third of that in 1900.

The following table shows the shipments by months from a single express office, Tahoe City, during four seasons. As stated above, no record was obtained from this office for 1901.

Month.	1900.	1902.	1903.	1904.
May	3,672	....	....	....
June	8,992	....	2,951	6,181
July	8,490	....	2,541	9,935
August	4,327	813	2,050	1,470
September	1,006	310	506	600
Total	26,487	1,123	8,048	18,186

During the three seasons, 1900, 1903, and 1904, the largest monthly shipments were made in June and July. In 1903 the largest monthly shipments from the express office at Tallac were made in the months of June and July and the same was also true of the shipments from McKinney's in 1900. About nine-tenths of the trout shipped are Tahoe trout, *Salmo henshawi.*

Mr. William Boyle informed the writer that the price of these trout has risen in the past twelve years from 10 cents a pound as a minimum to 35 cents per pound in 1903. During June of the past season, 1904, the fishermen received about 30 cents per pound. At the above prices the trout shipped in 1903 had a commercial value of $4,891.95, and in 1904, $6,819. Many of the trout that are shipped, however, are not placed on the market, for the successful tourist angler usually ships a large portion of his catch to relatives or friends. The trout shipped by the commercial fishermen are marketed chiefly in San Francisco, where they are retailed at 50 to 75 cents a pound. A small portion of each year's catch is marketed in Tahoe City, Cal., and Carson City, Nev.

The above figures, however, do not include two unknown but nevertheless very large elements of each season's catch, the trout used by the resort hotels and those consumed by campers and individuals who have summer homes around the lake. An attempt was made to obtain some idea of the amount consumed by the large hotels. The average daily consumption of each hotel during this investigation was obtained and on this basis an estimate was made for a season of ninety days. The sum total of these estimates approximates 10,000 pounds. This, added to the trout shipped from the lake in 1904, gives a total of 28,186 pounds. This sum accounts for only two parts of the season's catch. It is impossible to give an estimate of the third part, that is, the local consumption other than that of the hotels.

Some idea of the "luck" of the fishermen may be gained from the following record of two who were located at the outlet of the lake. This shows the number of trout caught by each on the days indicated.

Date.	Trout caught.	
June 29	7	2
June 30	12	14
July 1	14	12
July 2	12	5
July 3	8	....
July 5	13	....
July 6	14	....

In weight, these trout averaged about 2 pounds. They were all Tahoe trout, *S. henshawi*. These fishermen usually started early in the morning, about sunrise, and returned about the middle of the afternoon. One catch was recorded, however, in which 11 trout were caught between 8 and 11.30 a. m.

Whitefish and suckers are abundant in the lake, but have no commercial value.

The regular flat-bottomed boat is used for fishing purposes, and each of these boats is provided with a tank or well in which the trout may be kept alive. These tanks will hold from 20 to 120 fish. About 80 of these fishing boats were found on the lake, and the average cost was about $30 each, so that the whole represented an investment of $2,400.

The importance of the Truckee River as a trout stream is suggested from the following record of shipments of trout from towns along its course during the season of 1900:

California.		Nevada.	
Locality.	Pounds.	Locality.	Pounds.
Truckee	24,978	Verdi	10,704
Boca	5,824	Reno	10,819
Floriston	4,374	Wadsworth	39,388

This gives a total shipment of 96,087 pounds for this one season.

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A STUDY OF TWIN LAKES, COLORADO, WITH ESPECIAL CONSIDERATION OF THE FOOD OF THE TROUTS.

By CHANCEY JUDAY,
Wisconsin Geological and Natural History Survey.

BUREAU OF FISHERIES DOCUMENT NO. 616.

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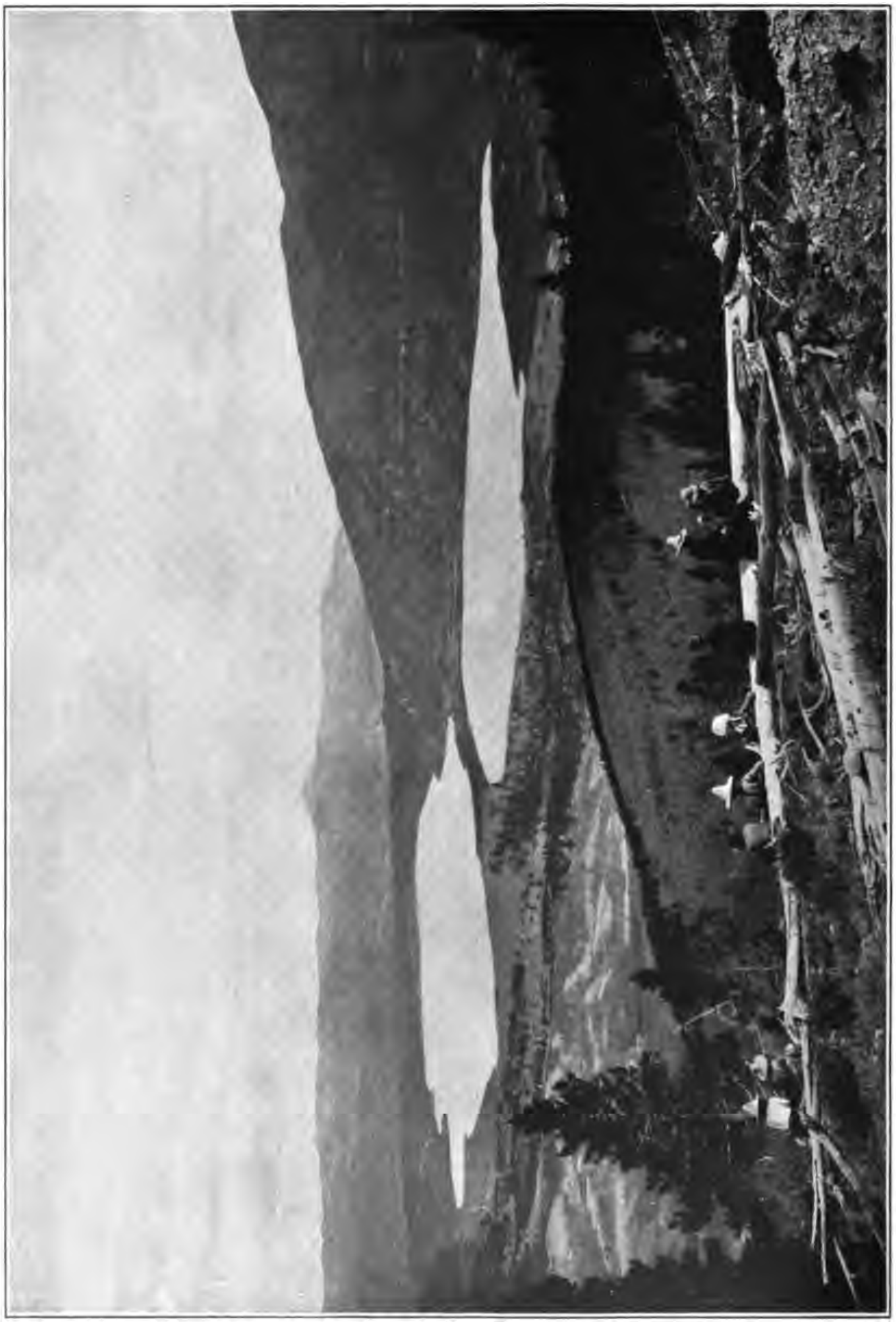

VIEW OF TWIN LAKES FROM SIDE OF MOUNT ELBERT. LOOKING SOUTH OF EAST.

UNIV. OF MICH.

A STUDY OF TWIN LAKES, COLORADO, WITH ESPECIAL CONSIDERATION OF THE FOOD OF THE TROUTS.[a]

By CHANCEY JUDAY,
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PHYSICAL CHARACTERISTICS OF THE LAKES.

LOCATION.

These two beautiful sheets of limpid water lie in the southern part of Lake County, Colorado, about 15 miles south-southwest of the city of Leadville, nestled at the base of the highest mountains in the state. Viewed from the east, they have for a background the loftiest peaks of the Sawatch Range, which extends north and south immediately behind them. Rising from the lake basin on the northwest are spurs and ridges which lead up to Mount Elbert. This mountain has an altitude of 14,421 feet (4,395.5 meters), and is only 3 feet lower than Mount Massive, its neighboring peak on the north, which is said to be the highest in Colorado. La Plata peak, rising but a short distance southwest of the lakes, has an altitude of 14,342 feet (4,371 meters), while between La Plata and the lakes are lofty ridges with peaks having an altitude of probably 13,000 feet (4,000 meters) or more. As the ridges extend down to the lakes, the southern shores are very steep. The general contour of the country surrounding the lakes is shown in plate III.

ORIGIN AND SIZE.

The lakes lie a short distance below the mouth of Lake Creek Canyon. This canyon extends westward between Mount Elbert and La Plata, and there are many evidences to show that it was once occupied by a glacier which probably came down and joined the glacier that occupied the canyon of the Arkansas River. Much of the débris brought down by the Lake Creek glacier was deposited in the lateral moraines which form high ridges on either side of the lower valley. Thus the lakes are entirely surrounded by morainal detritus with no rock in place exposed along the shores except for a short distance along the north shore of Lower Lake. The glacier was no doubt active in scooping out the lake basins, and then as it receded two terminal moraines were formed, one which maintains the water in Lower Lake and a second one, about 225 yards (200 meters) wide in its narrowest part, which separates the two lakes. These lateral and terminal moraines are well shown in sketch maps by Holmes in Hayden's Report for 1874 (between p. 48 and 49).

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[a] Study made for the United States Bureau of Fisheries during the summers of 1902 and 1903.

Upper Twin Lake at its usual stage of water about midsummer has an area of about 474.5 acres (192 hectares) and Lower Lake about 1,440 acres (582 hectares). Both lakes were, no doubt, considerably larger during their earlier stages. The portion of Lake Creek below Lower Lake has worn a channel over 20 feet (6 meters) deep through the old terminal moraine, and it therefore seems probable that the lake was several feet deeper at some time in its past history, which greater depth would increase its size very materially. An increase in the depth of Lower Lake would soon affect Upper Lake also, as the fall between the two is only about 6 or 7 feet (2 meters). Moreover, Upper Lake, at no distant time, geologically speaking, probably extended much farther west than it does at the present time. The débris brought down by the various streams that flow into its western end has formed a swampy meadow of considerable extent, and it seems probable that much, if not all, of this area was covered with water during the early history of the lake, and thus constituted a part of it.

DEPTH AND VARIATION IN LEVEL.

In Hayden's Report for 1873, figure 11 is a sketch map showing the results of a number of soundings in each lake. The greatest depths found by him were 79 feet (24 meters) in Upper Lake and 76 feet (23 meters) in Lower Lake. Powell also published a map of the lakes (1891, pl. LXXXI). He states that 44 soundings were made in Upper Lake and 86 in Lower Lake but gives no results in figures.

In the present investigations 94 soundings were made in Upper Lake and 85 in Lower Lake, the lines being run in a general north and south direction across each lake in order to make them as short as possible and thus reduce the chance of error to a minimum. On July 8, 1902, the greatest depth found in Upper Lake was 82 feet (25 meters) and two weeks later the maximum depth found in Lower Lake was 74 feet (22.5 meters). When these soundings were made the water in Upper Lake was at about its normal stage, but Lower Lake was about a foot lower than usual at this time of year. While the maximum depth of Lower Lake is only 8 feet (2.5 meters) less than that of Upper Lake, its average depth is very much less, as much of the eastern half of Lower Lake is comparatively shallow.

It was impossible to determine the natural fluctuation in the level of the lakes. Since the spring of 1901 they have been used as a storage reservoir by the Twin Lakes Reservoir Company. The surplus water of the basin is stored here during the flood season and later is withdrawn for the purpose of irrigating lands in the vicinity of Sugar City, Colo. A dam 18.5 feet (5.6 meters) high is now maintained in the old outlet and the present outlet is a canal. The dam and the canal are so constructed that there is a difference of 25.5 feet (7.8 meters) between extreme high water and extreme low water in Lower Lake. The possible variation in the level of Upper Lake is about 6 or 7 feet (2 meters) less, as already indicated. It is proposed, however, to dredge the creek connecting the two lakes so that they may have the same possible fluctuation in level. Concerning the natural fluctuation in level previous to the building of the dam, Powell stated, in 1891, "it is not likely that the surface of the lakes varies more than 2 feet in altitude during the year."

AFFLUENTS.

The principal affluent is Lake Creek, which rises in the Sawatch Range. Some distance above the lakes the creek divides into two branches. The north or main branch has its beginnings in amphitheaters up near the crest of the mountains, a little to the northwest of Mount Elbert. It flows south and southeast for a distance of about 10 miles (16 kilometers), and then east about 8 miles (12.8 kilometers) into Upper Lake. The south fork rises in amphitheaters lying west and southwest of La Plata, flows northeast about 8 miles, and joins the north fork. Powell (1891) states that Lake Creek drains about 102 square miles (261 square kilometers) of high mountain country. At present, however, not all the water of the creek reaches the lakes. About 5 miles (8 kilometers) above Upper Lake considerable water is diverted into a ditch which furnishes a water supply for placer mining in the vicinity of Granite. During the late summer, when the water in Lake Creek is especially low, it is said that so much is removed by this ditch that frequently portions of the creek below are entirely dry and large numbers of brook trout perish there. At the point where Lake Creek emerges from its canyon there was formerly a fall of sufficient height to prevent the trout from ascending the stream, but a few years ago much of this rock was removed by blasting and trout may now ascend the creek without difficulty.

About a dozen other streams of various sizes contribute their quota of water to the lakes.

CHARACTER OF SHORES AND BOTTOM.

As stated before, the lakes are entirely surrounded by morainal detritus, so that the shores are composed very largely of sand and gravel. In places, however, there are rocks varying in size from mere cobblestones to huge bowlders. At present the cutting action of the waves on the shore is very slight in most places. At two points on Lower Lake, however, one on the north side and the other on the south side, the waves have recently been cutting the shores very rapidly. The increased height of the water caused by the dam has directed wave action at these points against loose morainal banks that are steep and easily cut away. Along some parts of Upper Lake the action of the ice on the shores was well illustrated by the small ridges of shore material that had been pushed up just a few feet back of the water's edge.

The bottom of the shallower parts of the lakes is sandy and gravelly for the most part, but it is composed of bowlders of various sizes in some places. In the deeper water a marly deposit covers the bottom.

TRANSPARENCY OF THE WATER.

The transparency of the water of both lakes varied somewhat during the period of these observations. It was found that, in general, a Secchi's disk just disappeared from view at a depth of about 18 feet (5.5 meters) early in July, and the water gradually became more transparent as the season advanced, so that, by the middle of August, this depth had increased to a maximum of 29.5 feet (9 meters). The low transparency early in the season was due to the fact that the snow on the mountains was melting rapidly and the streams in consequence were swollen and more or less roily. As summer advanced they became smaller and their water became clear.

The transparency of the water of the lakes was quickly affected by roily affluents. If a heavy rain occurred in Lake Creek Canyon so as to fill the water of the creek with silt, the water of the lakes soon responded with a marked decrease in transparency.

The maximum transparency of these lakes exceeds by 10 feet (3 meters) that which the writer found in several lakes in southeastern Wisconsin in 1900, and it also exceeds by 21 feet (6.5 meters) that found in Winona Lake, Indiana, in 1901. These waters are not so transparent as Lake Tahoe, however. Le Conte (1883) records that in August, 1873, he found that a white plate was still visible at a depth of 108 feet (33 meters) in Lake Tahoe, and in June, 1904, the present writer found the transparency to be 65 feet (19.8 meters).

TEMPERATURE OF AIR AND WATER.

The lakes are about 9,200 feet (2,804 meters) above sea level, consequently the water does not attain a very high temperature during the summer because of the climatic conditions at this altitude. In 1902 snow fell as late in the summer as July 5 and as early in the fall as August 25. In 1903 two or three inches of snow fell on June 10, and flurries were recorded for July 3. No snow was noted down as low as the lakes until September 6, but some of the surrounding mountains were covered as early as August 24.

Some observations of the temperature of the air were made, but on account of other work, they were not taken on some days; and it was found impracticable, also, to make them each day at exactly the same hour. The average results, however, will give a general idea of the daily range of temperature. The following table shows the maxima, minima, and averages of readings taken between 6 and 7 a. m., 12 noon and 1 p. m., 6 and 7 p. m., and 9 and 10 p. m.

Year.	Month.	Hour.	Number of readings.	Maxima.		Minima.		Averages.	
				Degrees Fahrenheit.	Degrees Centigrade.	Degrees Fahrenheit.	Degrees Centigrade.	Degrees Fahrenheit.	Degrees Centigrade.
1902	July	6-7 a. m.	15	56.0	13.3	40.5	4.7	48.5	9.2
1902	....do	12-1 p. m.	18	85.0	29.4	47.5	8.6	71.0	21.6
1902	....do	6-7 p. m.	20	77.0	25.0	48.0	9.0	64.3	18.0
1902	August	6-7 a. m.	20	54.0	12.2	41.0	5.0	48.0	9.0
1902	....do	12-1 p. m.	15	81.5	27.5	56.0	13.3	67.8	19.9
1902	....do	6-7 p. m.	21	72.0	22.2	52.5	11.4	61.2	16.2
1903	July	6-7 a. m.	15	60.0	14.4	38.8	3.8	50.3	10.2
1903	....do	12-1 p. m.	11	84.8	29.3	65.5	18.6	74.7	23.7
1903	....do	6-7 p. m.	16	73.0	22.8	38.8	3.8	60.9	16.0
1903	....do	9-10 p. m.	10	58.8	14.9	38.0	3.3	49.8	9.9
1903	August	6-7 a. m.	14	48.5	9.2	31.0	− 0.5	43.0	6.1
1903	....do	12-1 p. m.	17	82.5	28.0	60.5	15.8	75.0	23.9
1903	....do	6-7 p. m.	7	75.0	23.9	53.0	11.7	66.3	19.0

The days are usually warm and pleasant in summer, but the temperature falls rather rapidly after sunset. The nights are very cool, generally, and hoar frost may be expected every month of the year.

These climatic conditions explain why the water of the lakes never attains a very high temperature. In fact the lakes are generally covered with ice for a period of about five months each year. The following table shows the dates on which the lakes became completely covered with ice early in the winter, and those on which it disappeared from them in the spring, with a third column containing the number of days the lakes were covered with ice. I am indebted to Mr. Charles L. Willis for the data concerning Upper Lake, and to Mr. John J. Hartman for that pertaining to Lower Lake.

Periods in 1901–1905 during which Twin Lakes were icebound.

Date of freezing over.	Date of opening.	Number of days covered.	Date of freezing over.	Date of opening.	Number of days covered.
Upper Lake:			Lower Lake:		
December 16, 1901	May 8, 1902	143	December 15, 1900	May 12, 1901	148
December 13, 1902	May 16, 1903	149	December 16, 1901	May 12, 1902	147
December 16, 1903	May 3, 1904	138	December 11, 1902	May 15, 1903	155
December 19, 1904	May 8, 1905	140	December 11, 1903	May 12, 1904	152
			December 28, 1904	May 19, 1905	142

The records of the freezing over show only the dates on which the lakes became completely covered with ice. For some time previous there was considerable ice on both lakes, particularly around the edges and in the protected bays. Thus, it will be seen that Upper Lake was icebound for 138 to 149 days, and Lower Lake for 142 to 155 days each winter during the period covered by these observations. While no temperature observations were made during these periods, it can safely be said that the temperature of the water must have been tolerably low for a period of at least five months each year. It will also be noted that Upper Lake was not covered with ice quite so long as Lower. For the winter 1902–3, Mr. Hartman reported the maximum thickness of ice on Lower Lake as 34 inches (86 centimeters), and Mr. Willis found a maximum of 28 inches (71 centimeters) on Upper Lake. For the latter lake also, Mr. Willis reported a maximum of 24 inches (60 centimeters) for the winter 1903–4.

Several sets of temperature observations were made on these two lakes during the months of July and August in 1902 and 1903. In general the temperature conditions during the summer were found to be similar to those that have been observed in lakes of corresponding size and depth at much lower altitudes—that is, the same three regions were noticeable. There was an upper stratum of water, or superthermocline region, whose temperature increased materially during the summer; a bottom stratum, or subthermocline, whose temperature changed very little during the summer; and a more or less distinct transition zone or thermocline between these two strata. The thermocline region is always characterized by a considerable change in the temperature of the water within a comparatively thin stratum. This stratum was found to be from 3 to 4 meters (10 to 13 feet) thick in these lakes, and the water in the lower portion of it was about 5° C. (9° F.) colder than that in the upper portion. The decrease in temperature with increasing depth both above and below this region, was much more gradual. This transition zone was not nearly so pronounced, however, in these lakes in late summer as has been found by the writer in lakes in southeastern Wisconsin and northern Indiana, but it agrees very closely with this zone in the latter lakes when their upper stratum of water has a corresponding temperature early in the summer. During these observations westerly winds blew with considerable regularity, beginning usually about 10 a. m., and lasting till late in the afternoon. As a result the water of the superthermocline region was kept quite thoroughly stirred up, so that its temperature was tolerably uniform, thus producing a fairly distinct thermocline. The superthermocline was considerably thicker in Lower than in Upper Lake, on account of the fact that the wind was more effective in disturbing the upper water of the former because of its much larger size.

In the accompanying temperature curves the vertical spaces represent the depth of the water in meters, and the horizontal spaces show the temperature in degrees centigrade.

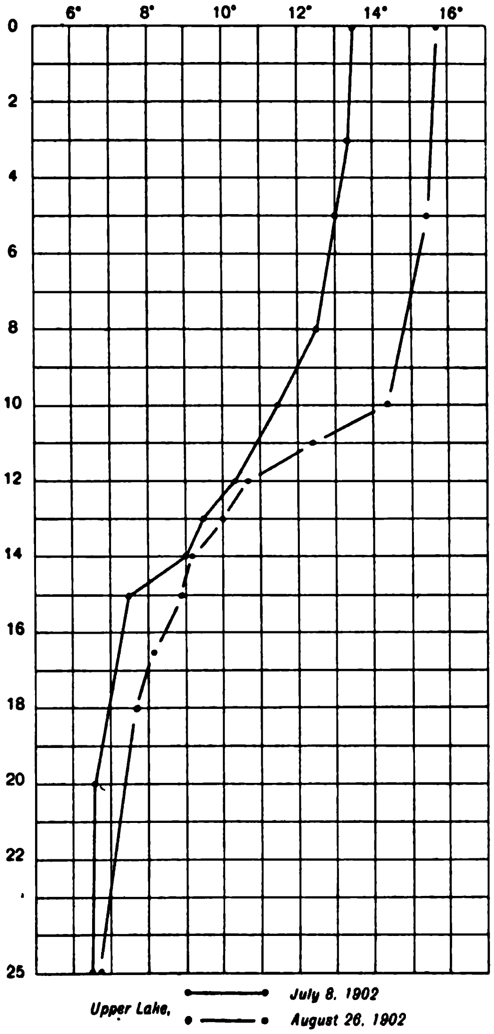

FIG. 1.

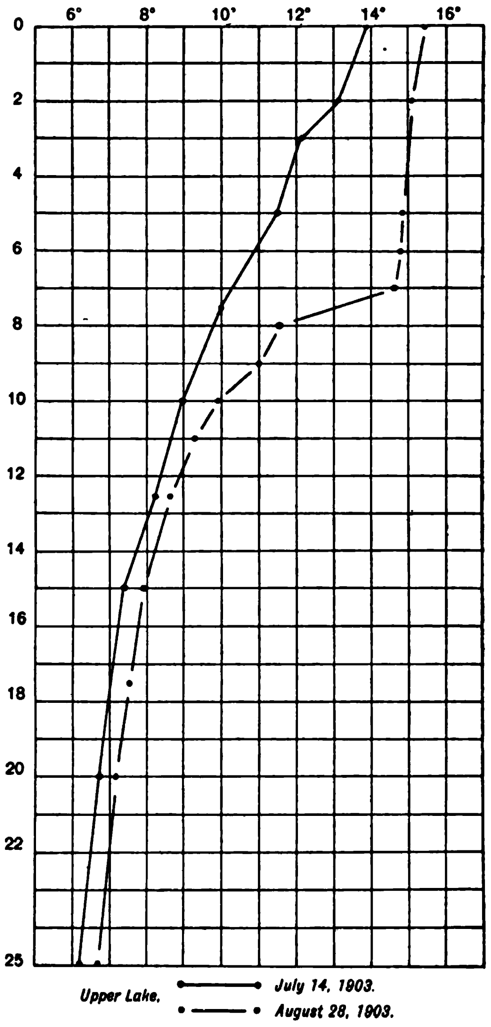

FIG. 2.

Figures 1 and 2 indicate the temperature changes that occurred in Upper Lake in 1902 and 1903 during the time of the observations. It will be noted that the superthermocline was not so thick in 1903 as in 1902, but that the thermocline was more sharply defined in the former year. In 1902 the upper 5 meters (16 feet) of water reached the summer maximum of 16.6° C. (62° F.) on August 4, remained practically the same for ten days, and then gradually decreased. In 1903 a maximum of 16.1° C. (61° F.) was noted on August 7. The bottom temperature was about the same both summers and changed very little during the two months, averaging about 6.5° C. (43.8° F.).

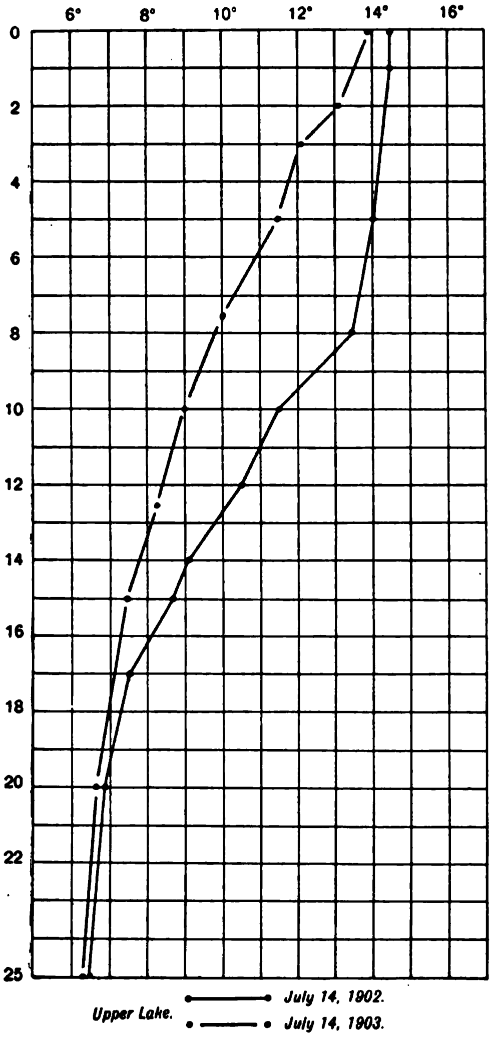

FIG. 3.

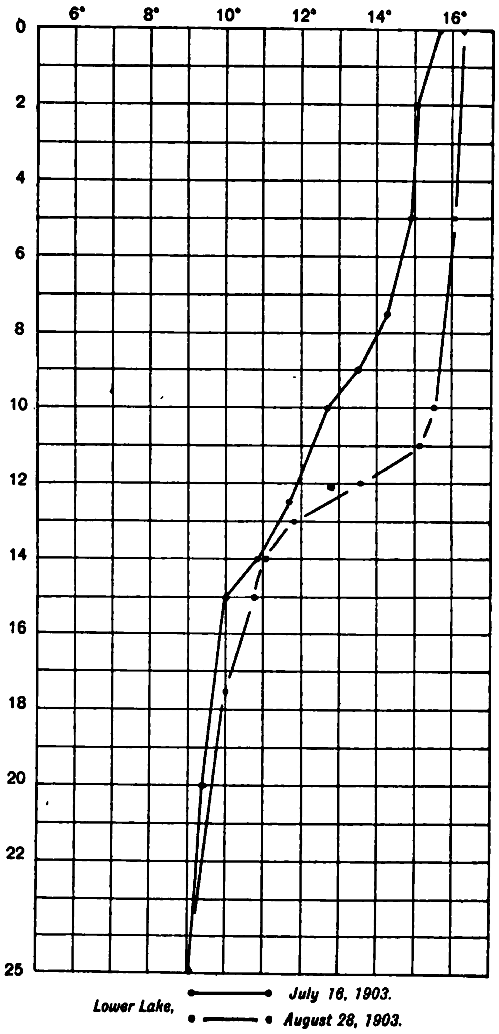

FIG. 4.

Figure 3 represents two sets of observations on Upper Lake which were made just one year apart. These curves show that down to a depth of 17 meters (55 feet) the water was considerably warmer in 1902 than in 1903, and slightly warmer thence to the bottom.

Figure 4 shows the comparatively slight change in temperature that occurred in Lower Lake between July 16 and August 28, 1903. The upper stratum became somewhat warmer and more thoroughly mixed, thus making the thermocline a little more pronounced. In 1902 the surface water had a temperature of 17.1° C. (62.8° F.) on August 21 and a maximum of 17° on August 7, 1903.

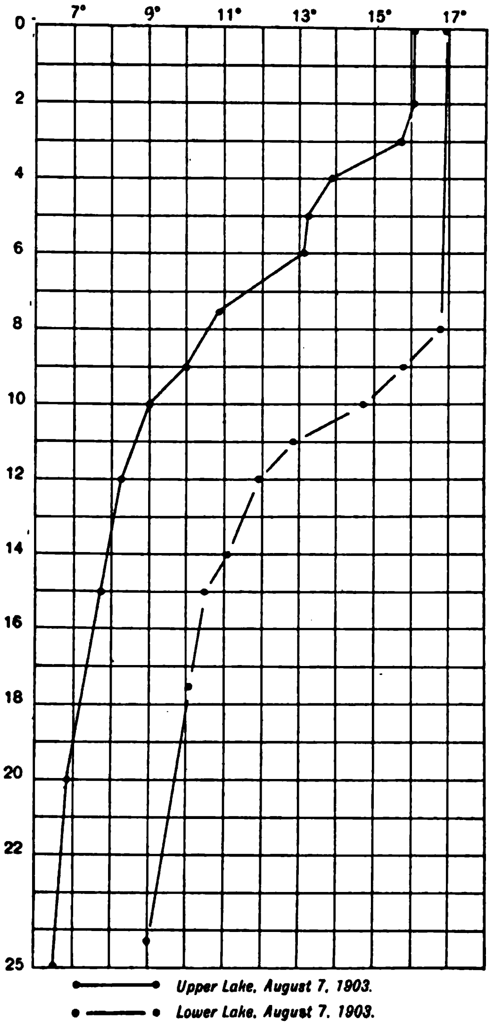

FIG. 5.

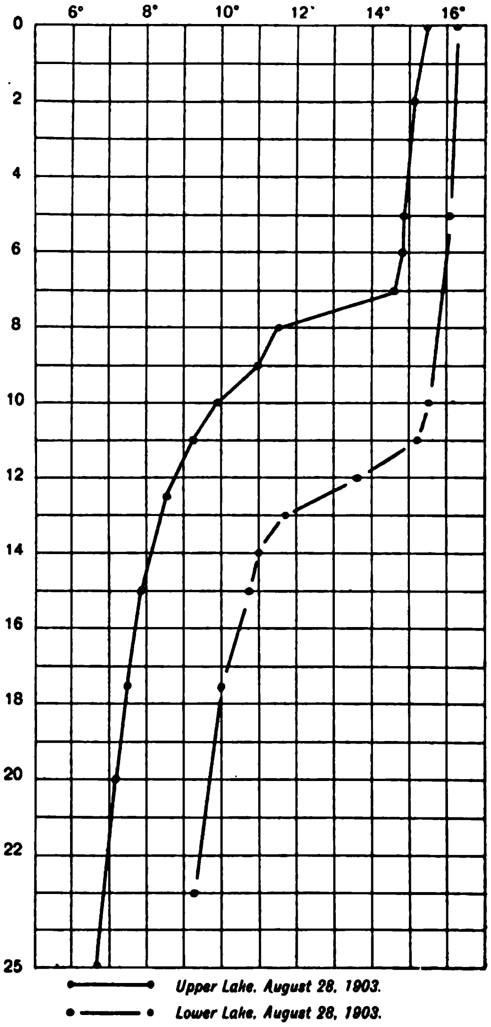

FIG. 6.

Figures 5 and 6 are comparisons of the temperature readings obtained for the two lakes on August 7 and 28, 1903. During these three weeks the thermocline moved down about 3 meters (10 feet) in each lake. Both summers the temperature of Lower Lake throughout its entire depth was somewhat higher than that of Upper Lake. This condition may be attributed to the following factors:

By far the greater part of the water which flows into Lower Lake during the summer comes from Upper Lake and thus has about the same temperature as the surface of the latter. The water flowing into Upper Lake, however, through all except one of its affluents was found to be 3° to 4° C. colder than the water above the thermocline. In 1903, for instance, the temperature of the water in Lake Creek, which is the chief affluent of Upper Lake, was 13.6° C. (56.5° F.) on August 7 and 11.2° C. (52.2° F.) on August 28. On these dates the surface temperatures of Upper Lake were, respectively, 16.1° C. (61° F.) and 15.4° C. (59.7° F.). On August 7 the temperature of the water in some of the other affluents was as follows: Willis Creek, 12.6° C. (54.7° F.); creek flowing into Elbert Bay, 25.5° C. (78° F.); creek on Royston Point, 12.5° C. (54.5° F.), and the water of a spring on Royston Point had a temperature of 6.4° C. (43.5° F.). Lower Lake is a little more than three times as large as Upper, and the wind is thus much more effective in disturbing the water of the superthermocline region. As one result this stratum of water was about two and a half times as thick in Lower Lake as in Upper. On August 7, 1903, for example, it was 3 meters (10 feet) thick in Upper and 8 meters (26 feet) thick in Lower Lake.

Likewise this greater disturbance of the water would affect the subthermocline by producing currents strong enough to affect the water throughout its entire depth. So large a portion of Lower Lake is comparatively shallow that its average depth is much less than that of Upper Lake. Thus, the sun is much more effective in warming the water of the former. In the shallower water the light that is not absorbed by the water itself is changed to heat when it reaches the bottom, and most of this heat will be absorbed by the water above, so that nearly all the sun's energy is used up in warming a tolerably thin stratum. Where the water is deeper the light will penetrate to a greater depth and the same amount of energy falling on an equal area will be distributed through a much larger quantity of water and will thus not raise its temperature so much.

The following table shows two sets of temperature observations on each lake:

Temperatures in Twin Lakes in summers of 1902 and 1903.

Depth.	UPPER LAKE.				LOWER LAKE.			
	August 4, 1902.		August 7, 1903.		August 21, 1902.		August 7, 1903.	
Meters.	° *C.*	° *F.*	° *C.*	° *F.*	° *C.*	° *F.*	° *C.*	° *F.*
0.0	16.6	62.0	16.1	61.0	17.1	62.8	17.0	62.7
3.0	....	....	15.7	60.2	....	....	....	....
4.0	....	....	13.9	57.0	....	....	....	....
5.0	16.6	62.0	13.8	56.0	16.3	61.4	16.9	62.5
6.0	....	....	13.2	55.7	....	....	....	....
7.5	....	....	10.8	51.5	....	....	....	....
8.0	15.3	59.5	....	....	16.0	60.8	16.8	62.3
9.0	13.5	56.4	10.0	50.0	....	....	15.8	60.5
10.0	11.5	52.8	9.0	48.3	15.9	60.5	14.7	58.5
11.0	....	....	....	....	....	....	12.8	55.0
12.0	10.0	50.0	8.3	47.0	15.0	59.0	11.9	53.5
13.0	10.0	50.0	....	....	....	....	....	....
14.0	8.3	47.0	....	....	13.5	56.3	11.1	52.0
15.0	7.8	46.0	7.7	45.8	12.5	54.5	10.5	51.0
18.0	....	....	....	....	11.9	53.4	10.1	50.2
20.0	6.8	44.3	6.8	44.3	10.7	51.3	....	....
22.0	....	....	....	....	10.1	50.2	....	....
25.0	6.5	43.7	6.5	43.7	....	....	9.0	48.2

AQUATIC VEGETATION.

Potamogeton was found to be more abundant than any of the other large forms of aquatic plants. It grew in considerable abundance at the west end of Upper Lake, along the north side of Lower Lake, from North Bay west, and also in the shallow water of the east end. In some places where the water was 10 feet (3 meters) deep it came almost to the surface. Three different species and one variety were found, *Potamogeton nuttallii*, *P. perfoliatus*, *P. perfoliatus richardsonii*, and *P. prælongus*. One or two species of *Carex* were found in the pools of the swampy meadow west of Upper Lake and in a very few places along the edges of the lakes. *Batrachium trichophyllum* also was found in the pools and in a few places in the lakes.

PLANKTON.

FORMS.

A comparatively small amount of phytoplankton was found in the lakes, and it consisted chiefly of diatoms, *Fragilaria*, *Asterionella*, and *Melosira*. A small portion of it consisted of some colonies of a green alga, apparently a species of *Protococcus*, and an occasional desmid, *Staurastrum*.

The following animal forms were found in the plankton of the two lakes:[a]

ROTIFERA.

Anurea cochlearis Gosse.
Anurea aculeata Ehrenberg.
Notholca longispina Kellicott.
Triarthra longiseta Ehrenberg.
Polyarthra sp.
Asplanchna sp.

COPEPODA.

Diaptomus judayi Marsh.
Cyclops pulchellus Koch.
Cyclops serrulatus Fischer.
Cyclops albidus Jurine.
Cyclops viridis americanus Marsh.

CLADOCERA.

Daphnia hyalina richardi Burckhardt.
Latona setifera O. F. Müller.
Drepanothrix dentata Eurén.
Eurycercus lamellatus O. F. Müller.
Camptocercus rectirostris biserratus Schoedler.
Alona affinis O. F. Müller.
Alona guttata Sars.
Graptoleberis testudinaria Fischer.
Pleuroxus procurvatus Birge.
Chydorus sphæricus O. F. Müller.

The following Cladocera were obtained from pools in the swampy meadow west of Upper lake:

Daphnia pulex De Geer.
Scapholeberis mucronata O. F. Müller.
Simocephalus vetulus O. F. Müller.
Ceriodaphnia pulchella Sars.
Eurycercus lamellatus O. F. Müller.
Camptocercus rectirostris biserratus Schoedler.
Pleuroxus procurvatus Birge.

Some plankton material was collected in a lakelet above the town of Twin Lakes on Mount Elbert. This small body of water has an altitude of about 10,000 feet (3,050 meters). The Cladocera were represented by *Daphnia pulex*, *Simocephalus vetulus*, *Pleuroxus procurvatus*, and *Chydorus sphæricus*.

Some material was obtained also from Willis Lake, which is situated near the head of Willis Gulch, a little southwest of Twin Lakes, and has an altitude of about 12,000 feet (3,660 meters). The water was found to be very cold, the banks of snow which were the source of supply being only a short distance away. *Gammarus* was plentiful, and the Cladocera were represented by two forms, *Macrothrix hirsuticornis* Norman & Brady and *Eurycercus lamellatus* O. F. Müller.

QUANTITY.

The plankton observations on the two lakes were few in number and consisted only of vertical hauls. In 1902 the observations on Upper Lake consisted of two series of catches in July and four in August. A single set of catches was made in Lower Lake in August. In 1903 three sets of catches were made on each lake. The observations were so few in number and covered such a brief period of time each year that they give only a fragmentary notion of the plankton life of the lakes. Likewise the vertical haul method is by no means a satisfactory one and both of these factors must be taken into consideration in the results given below. The following table shows the number of thousands of individuals per square meter of surface. With the exception of a few figures for the rotifers, these numbers are averages of either two or three hauls. The rotifers were not counted in all the catches, so that in a few instances the numbers given for them represent only the individuals of a single catch.

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[a] I am indebted to Dr. C. Dwight Marsh for this list of Copepoda. The *Diaptomus* proved to be a new species and Dr. Marsh has recently described it.

Quantity of plankton in Twin Lakes, as shown by series of vertical hauls during summers of 1902 and 1903.

[Average number of thousands of individuals per square meter.]

Species.	UPPER LAKE.									LOWER LAKE.			
	1902.						1903.			1902.	1903.		
	July—		August—				July—	August—		August—	July—	August—	
	14.	20.	4	14.	18.	26.	14.	7.	28.	21.	16.	8.	28.
Anurea cochlearis	3.7	1.0	2.7	1.6	4.0	2.0	1.0	1.6	2.0	....	38.1	40.2	12.4
Anurea aculeata	7.5	18.0	14.0	.4	6.0	7.0	35.8	28.0	......	1.1	52.4	8.5	......
Notholca longispina	26.2	37.5	10.7	7.5	5.3	5.9	19.7	33.4	31.2	30.0	37.0	32.5	30.4
Triarthra longiseta	76.0	66.9	30.0	18.2	10.2	5.5	101.0	96.0	30.0	....	30.5	17.1	1.0
Polyarthra sp	......	......	......	......	......	......	8.5	8.0	3.8	....	9.0	24.0	2.7
Asplanchna sp	7.5	8.1	24.2	34.7	26.3	33.8	7.5	9.6	5.3	9.6	1.5	7.5	13.9
Diaptomus judayi	47.0	25.1	27.8	15.0	18.4	22.5	20.3	107.6	77.7	57.6	99.5	68.9	52.6
Cyclops	71.9	47.1	35.3	51.3	52.6	101.8	40.1	33.2	47.1	45.4	88.4	54.6	55.0
Nauplii	300.0	237.5	175.5	145.5	122.4	104.0	202.0	201.0	84.0	84.5	181.0	142.3	51.3
Daphnia hyalina, young and adult	157.9	130.5	58.2	48.3	25.0	30.4	27.8	96.3	64.2	28.2	151.0	68.0	64.6
Daphnia hyalina, adult	37.0	19.3	12.4	16.3	5.3	6.4	9.0	21.8	20.3	12.2	58.4	27.6	28.0

DISTRIBUTION.

With respect to vertical distribution, *Anurea cochlearis*, *Notholca longispina*, and *Asplanchna* were confined almost exclusively to the upper 10 meters. *Anurea aculeata* and *Triarthra longiseta* were found almost entirely below a depth of 10 meters, rarely occurring in the upper 10 meters. *Polyarthra* was rather evenly distributed throughout the entire depth of both lakes.

There was no diurnal movement of *Diaptomus*, *Cyclops*, and *Nauplii*. *Daphnia hyalina* showed a diurnal movement of half a meter in July and 1 meter in August.

The phytoplankton, as stated above, composed a comparatively small portion of the total plankton, and the few forms remained practically uniform in quantity during the two periods of these observations. The Crustacea made up by far the greatest bulk of the total plankton.

FISHES.

Catostomus commersonii Lacépède. Common Sucker; White Sucker.

This sucker is very abundant in the lakes. At times immense numbers were seen swimming at the surface with the dorsal fin and a part of the back projecting above the water. This habit was noted when the water was quiet, either early in the morning or in the evening. As food fish, the sucker does not stand very high in the estimation of local fishermen, consequently little attention is paid to it except as bait for trout. A few are caught in Lake Creek by means of grab hooks. Some of the trout feed rather extensively on young suckers.

Rhinichthys cataractæ dulcis Girard.

This minnow was found to be rather common in Lake Creek, both above and below the lakes, but only a few were noted in the lakes. Sometimes the fishermen use them for bait.

Salmo sebago Girard. Landlocked Salmon.

The landlocked salmon was introduced several years ago, but apparently has not multiplied very rapidly. Only a few are caught. The fish attains a rather large size, however, one that was caught weighing 6 and another 4½ pounds.

Salmo stomias Cope. Greenback Trout.

The greenback is one of the two indigenous species of trout. It is common in the lakes, apparently a little more abundant in Lower than in Upper lake. It does not attain a very large size, rarely exceeding a pound in weight. It is caught chiefly by trolling in shallow water.

Salmo macdonaldi Jordan & Evermann. Yellow-fin Trout.

The yellow-fin is the other indigenous trout--in fact, it has been found nowhere else as yet. Jordan (1891) has the following concerning its habits: "The Yellow-fin is largely on the gravels and about the north or sunny side of the lake. It is not often taken in deep water. It spawns in spring and the suckers devour the spawn in the streams and spawning beds." This trout appears to be very scarce now. No specimens of it were obtained.

Salmo irideus shasta Jordan. McCloud River Rainbow Trout.

This trout has steadily increased in numbers since its introduction, and is now the most abundant trout. It grows to a rather large size; one specimen was caught in 1903 which weighed 10 pounds. The larger ones are caught chiefly by trolling; the smaller ones are frequently obtained by fly-fishing in shallow water. Fairly large ones are often caught at the mouth of Lake Creek by bait-fishing from the shore.

Cristivomer namaycush Walbaum. Mackinaw Trout; Great Lakes Trout.

This trout has not increased very rapidly in numbers since its introduction into Twin Lakes, but it seems to find conditions favorable for its growth. During the first half of June, 1903, a number of specimens were caught which weighed from 15 to 20 pounds. Most of them were caught in the upper end of Lower Lake by still-fishing. The fishermen used large hooks baited with pieces of suckers.

Salvelinus fontinalis Mitchill. Brook Trout; Speckled Trout.

Brook trout are abundant in Lake Creek above the lakes, and many are caught in the lakes themselves. They are obtained chiefly by fly-fishing. In some cases, also, the fisherman baits his fly hook with grasshoppers or maggots.

IMPORTANCE OF STUDY OF FISH FOOD.

In considering the life conditions of a living organism, one of the most important factors to be taken into account is, naturally, the food. It is essential to know something about the quantity and kind of food required not only for existence, but also for the best and most complete development of the organism. In agriculture this question has received the attention of many investigators, and the results of their labors are apparent everywhere. To mention only two instances: We know that plants and soils have been studied to determine what plants are best adapted to the different kinds of soil; where certain food elements are lacking in a soil, fertilizers are added, or the soil is inoculated with bacteria which will produce the desired results. In stock feeding much has been done to determine the relative value and nutritive qualities of the various kinds of food generally employed, so that this industry may now be conducted along scientific lines. Comparatively little attention has been given to the food of our useful aquatic animals, however. The whole subject of aquiculture, in fact, has been very much neglected. Analyses have been made and we have been told that our regular food fishes are very nutritious and make an excellent food for us, but our knowledge as to what produces this nutritious food is entirely too limited. The whole question of the relation of quantity and quality of food to the rate of growth and physical well-being of fishes needs much more thorough investigation than it has yet received.

This neglect of aquiculture is certainly not due to its slight economic importance, or perhaps it would be better to say to small possibilities of its great economic importance. It has been estimated that a body of water of average fertility will produce five times as much as an equal area of average land. Sweeney (1898) calls attention to the fact that a small fish pond (60 by 120 feet) in Indiana produced 1,000 pounds of black bass and 250 pounds of yellow perch in fifteen months without being supplied with any artificial food. At the price of 8 cents per pound, he estimated that, if the natural waters of Indiana had been relatively only about a tenth as productive as this pond, the fish products would have been almost equal in value to the corn crop of the state in 1896, the year of this experiment, and a little more than twice the value of the wheat crop. Yet, in spite of the great possibilities of our natural waters from an economic standpoint, most of them receive little or no attention except annually or biennially when our legislators wrestle with the complex problem of devising laws for the protection of fish and aquatic birds. There is little doubt that, if more attention was given to investigations relative to increasing the producing efficiency of our natural waters, many of the stringent protective laws that now adorn our statute books would become superfluous.

Like other living organisms, fishes are affected by both the quantity and quality of the food available for them. The quantity of suitable fish food found in a stream or lake determines not only the number of fish that may be supported but also the physical condition of those that do survive. When food is scarce, a smaller number will be able to win in the struggle for existence, and those that do win will usually be poor and stunted in their growth. Fish epicures have persistently maintained that the flavor of a poorly fed fish is much inferior to that of one which has had an abundant supply of food. They also assert that the flavor is affected very much by the kind of food on which the fish feeds. It is stated, too, that the kind of food affects the growth of a fish very materially. Baird (1857) cites an experiment in which young trout, presumably the same number and of the same size, were placed in three separate tanks and were fed upon different kinds of food. The trout in one tank were supplied with worms; those in another were given live minnows; while those in the third were fed upon "water-flies." The trout which subsisted upon worms grew slowly and had a lean appearance; those which were supplied with live minnows became much larger; "whilst those which had flies alone given to them attained in a short time prodigious dimensions, weighing twice as much as both the others together." It is true, of course, that there is a very marked difference in the rate of growth of trout, even under apparently the same food conditions. Trout culturists, for instance, find it necessary to sort the young trout of a pond at regular intervals after they are a few months old, and separate the larger, precocious individuals from the smaller, weaker ones, in order to keep the former from preying upon the latter. But, in spite of this apparent contradictory evidence, there is little doubt that the great difference in the results obtained in the above experiment was due, in some measure at least, to the different kinds of food supplied.

As long ago as 1653 Walton appreciated the importance of the quality of the feeding ground, for he says: "And certainly, as some pastures breed larger sheep, so do some rivers, by reason of the ground over which they flow, breed larger trouts." Francis (1868) makes the assertion that "trout in one stream will be much larger, firmer, redder, and better shaped than in others. This may, in a measure, be owing to the greater abundance of food, but I have every reason to believe that it proceeds quite as much from the kind of food that they are enabled to obtain." Further on he says: "In lakes also it is a very common thing to find the trout in one lake large, bright, and well fed and in another, very similar in appearance and perhaps only a bare half mile distant from the other, they will be long, black, and lean, with heads out of all proportion to the thickness of the body. In another, probably but a similar distance from the first two, the trout will be abundant, but very small, though bright and well colored." To exemplify this he cites a group of small lakes in which he had fished and attributes the superior condition of the trout in the smallest lake of the group to the abundance and greater variety of the food found in it. Baird (1857) cites a similar difference between the trout of two streams, one of which is a tributary of the other, and he ascribes it to the great difference in the quantity and variety of the fish food which he found in the two waters.

Thus it is evident that a knowledge of both the quantity and kinds of food found in a stream or lake is of very great importance when it comes to the question of trout culture. This, doubtless, is true also of the culture of all other fishes, and this knowledge would be very valuable in the introduction of a species of fish into new waters. If we know the kind of food on which the fish thrives best and if we also know the quantity and kinds of food available in the water to be stocked, then the problem of stocking the water can be attacked in such a way as greatly to increase the chances of success. Until such knowledge is acquired we must continue to experiment more or less blindly.

FOOD OF THE TROUTS.

Walton tells us that the trout "lies at watch for any fly or minnow that comes near him; and he especially loves the May-fly." In the two and a half centuries since Walton wrote, relatively little has been added to his observations on the feeding habits of most of the trouts, though several writers, especially writers on trout-culture, have commented in a general way upon the great variety of trout food. There is very little definite information as to the quantities and proportions of the various component elements, however. From general statements we learn that the food includes various kinds of worms, all kinds of insects (both adults and larvæ), mollusks of one sort or another, crustaceans, small fish, fish eggs—in fact, almost anything that is digestible, as well as many things that are not digestible. Trout are regarded as carnivorous from choice, but omnivorous in cases of necessity.

EXAMINATIONS OF TROUT STOMACHS.

During the investigation at Twin Lakes the stomachs of 394 trout were obtained and the contents studied. Twenty-six specimens were fry that were too small to be positively identified, and the other 368 belonged to six different species. The specimens were obtained during July and August, 1902, and between the middle of June and the 10th of September, 1903. They were caught by various methods, such as by trolling with a spoon-hook or baited hook, by fly-casting, with a seine, in gill-nets, and on trout-lines or set-lines. The fry, of course, were taken with a dip net. They were caught at various hours of the day, and under as favorable conditions as possible, so that the results might represent the natural food of the specimens.

Only a very general classification of the different elements of the stomach contents was attempted. They are recorded under twenty-two different heads. *Chironomus* and *Simulium* were noted separately from the other Diptera, because they were represented chiefly by their aquatic larvæ. The term "insect fragments" includes all fragments of insects that were too small to be identified. The other terms are self-explanatory.

In recording the contents of a stomach an estimate was first made as to the relative amount of food it contained; that is, whether it was well filled, half, or a quarter full, or contained only a little. Then the various constituents were sorted out, and the percentage of each in the entire quantity was carefully estimated. In the first six of the following tables the first column shows the number of specimens in which the respective elements appeared, and the second column shows the average per cent of each element in all the specimens that contained it. An explanation of the last table is given below.

Landlocked salmon (*Salmo sebago*).—Twenty-four specimens of landlocked salmon were examined. Twenty-three were obtained from Lower Lake and one from the pool just below the gates, or dam, in the outlet canal. The length of the specimens varied from 8 to 23.5 inches (20 to 70 centimeters). Two stomachs were entirely empty, another contained only a grain of oats, while two others contained only a few grains of coarse sand. Thus nineteen are accounted for in the following table:

Contents of stomachs of 19 landlocked salmon.

Food elements.	Number of specimens in which found.	Average per cent of element.	Food elements.	Number of specimens in which found.	Average per cent of element.
Fish remains	7	100.0	Hymenoptera (ants)	1	20.0
Trichoptera (larvæ and pupæ)	2	95.0	Insect fragments	1	20.0
Lepidoptera	1	40.0	Crustacea (Gammarus)	1	5.0
Diptera	2	52.5	Mollusca	1	1.0
Chironomus (larvæ and pupæ)	1	2.0	Vegetable débris	4	62.0
Simulium (larvæ)	1	100.0	Sand and gravel	6	61.0
Coleoptera	4	73.0			

The specimen containing *Simulium* larvæ was the one caught in the pool below the dam. The intestines of several specimens contained a great deal of sand and mud and the shell of a small bivalve mollusk was found in one.

Greenback trout (*Salmo stomias*).—The stomachs of 72 greenback trout were examined. Eight of them were empty, leaving 64 to be accounted for in the table. Of this number, 18 were obtained from Upper Lake, 1 from Lower Lake, and 53 from the pool below the dam.

Contents of stomachs of 64 greenback trout.

Food elements.	Number of specimens in which found.	Average per cent of element.	Food elements.	Number of specimens in which found.	Average per cent of element.
Fish remains	4	70.0	Chironomus (larvæ and pupæ)	10	17.75
Orthoptera	7	59.7	Coleoptera	25	42.7
Hemiptera	2	6.0	Hymenoptera (ants)	5	19.4
Trichoptera	1	10.0	Insect fragments	29	51.7
Lepidoptera (moths)	14	42.0	Crustacea (Entomostraca)	14	77.0
Diptera	29	30.8	Vegetable débris	7	38.4

Specimens from all three localities contained *Daphnia*. One stomach contained 4,500 *Daphnia* and another 2,250. Two of the specimens had eaten both copepods and *Daphnia*, but the other 12 of the 14 that had eaten Entomostraca contained *Daphnia* only.

The vegetable débris consisted chiefly of *Potamogeton* leaves.

A feather was found in one stomach and a few pieces of twine in another.

Jordan (1891) says, concerning the food of this species: "At the hatchery of Dr. Laws, it appears that this trout will not willingly eat young suckers and minnows, its food being largely young crustacea." It will be noted in the above table that only 4 stomachs out of 64 contained remains of fishes.

Rainbow trout (*Salmo irideus shasta*).—The stomachs of 114 rainbow trout were examined. Out of this number 8 were empty, 36 were estimated to be a third full or more, and the other 70 a quarter full or less. The specimens varied in length from 6 to 18 inches (15 to 45 centimeters). Twenty-two of them were caught in Upper Lake, 24 in Lower, and 68 in the pool below the dam in the outlet canal.

Contents of stomachs of 106 rainbow trout.

Food elements.	Number of specimens in which found.	Average per cent of element.	Food elements.	Number of specimens in which found.	Average per cent of element.
Mammal remains	1	42.0	Chironomus (larvæ and pupæ)	12	10.8
Fish remains	42	67.3	Simulium (larvæ)	3	68.3
Araneida (spiders)	1	10.0	Coleoptera	37	22.2
Odonata	2	2.5	Hymenoptera	21	5.6
Orthoptera	3	4.3	Insect fragments	61	55.1
Hemiptera	11	2.6	Crustacea	16	37.8
Trichoptera	3	4.7	Mollusca	1	40.0
Lepidoptera (moths)	27	13.6	Vegetable débris	26	35.6
Diptera	35	8.9	Sand and gravel	19	41.8

About a fourth of the fish remains were positively identified as remains of young suckers (*C. commersonii*) but the rest were not recognizable. These results do not agree with the observations of Chambers (1887), who states that the rainbow trout introduced into England "is more delicate in its appetite than other varieties of Salmonidæ, and therefore is not prone to the same temptations to cannibalistic attacks upon its congeners." In the present case, out of a total of 106 specimens containing food, 42 had partaken of fish; and while all the remains that could be identified were found to be suckers, it does not seem at all unlikely that the rainbow occasionally preys upon young trout too, since small fish constitute such an important element of its food.

Of the 16 specimens that contained Crustacea, one had eaten *Gammarus*, one copepods, another Diaptomi and *Daphnia*, while the other 13 had partaken of *Daphnia* only. One stomach contained 1,350 *Daphnia*.

The vegetable débris consisted of spruce leaves, pieces of wood, *Potamogeton* leaves, and algæ. One stomach contained a piece of cotton twine and another a feather. Much of the vegetable débris was probably taken by accident, but some had apparently been eaten on purpose. Much of the sand was probably derived from the cases of trichopter larvæ.

Mackinaw trout (*Cristivomer namaycush*).—Two Mackinaw trout were obtained. One was 30 inches (76 centimeters) long, and its stomach contained a trout 7 inches (17.5 centimeters) long and a few insect fragments; the other specimen was 33 inches (84 centimeters) long, but its stomach was empty. Mr. Willis examined the stomachs of several large specimens caught in 1903 and found that they contained almost nothing but young suckers.

Milner (1874) states that in the Great Lakes this trout feeds principally on the cisco (*Argyrosomus hoyi*). "It is not an unusual thing for a trout to swallow a fish too large for its stomach and the tail protrudes from his mouth until the forward part is digested." He also says that it eats refuse from the tables of passing steamers; such articles as peeled potatoes, pieces of liver, green corncobs, and fragments of ham bones having been found in stomachs. Goode (1884) says that Mackinaw trout are as omnivorous as cod.

Small brook trout (*Salvelinus fontinalis*).—Twenty-nine specimens of small brook trout from 1 to 2 inches (2.5 to 5 centimeters) long were obtained in July and August, 1902. They were caught in Lake Creek, above and between the lakes, and in Upper Lake. The stomachs of all of them contained food, and most of them were estimated to be from a third to two-thirds full.

Contents of stomachs of 29 small brook trout.

Food elements.	Number of specimens in which found.	Average per cent of element.	Food elements.	Number of specimens in which found.	Average per cent of element.
Ephemerida	11	59.0	Chironomus (larvæ and pupæ)	11	20.3
Plecoptera	1	25.0	Simulium (larvæ)	4	46.2
Orthoptera	2	22.5	Coleoptera	1	5.0
Lepidoptera (moths)	1	20.0	Insect fragments	22	63.6
Diptera	10	83.7	Vegetable débris	1	10.0

Large brook trout (*Salvelinus fontinalis*).—The specimens of larger brook trout numbered 127 and varied in length from 4 to 13 inches (10 to 33 centimeters). Of this number, 117 were caught in Lake Creek above Upper Lake, 7 in Upper and 3 in Lower Lake. Only one stomach was empty; 79 were estimated to be a third full or more and the remainder a quarter full or less.

Contents of stomachs of 126 large brook trout.

Food elements.	Number of specimens in which found.	Average per cent of element.	Food elements.	Number of specimens in which found.	Average per cent of element.
Fish remains	2	92.5	Diptera	18	14.0
Araneida	8	12.4	Chironomus (larvæ and pupæ)	42	11.0
Hydrachnidæ (water mites)	13	4.4	Coleoptera	43	15.7
Ephemerida	2	34.0	Hymenoptera	35	32.8
Orthoptera	10	47.0	Insect fragments	85	44.8
Hemiptera	8	13.6	Crustacea (Entomostraca)	2	4.5
Neuroptera	2	10.0	Vegetable débris	71	64.0
Trichoptera	4	22.5	Sand and gravel	20	15.5
Lepidoptera (moths)	9	16.4			

The fish remains consisted of young suckers. All of the specimens that had eaten Araneida and Hydrachnidæ came from Lake Creek. About one-fourth of the Hemiptera were *Corixa*, and about one-half the Hymenoptera were ants.

One of the two specimens containing Entomostraca was taken in Upper Lake and had eaten only *Daphnia*, while the other was caught in Lower Lake and had eaten both *Daphnia* and *Cyclops*.

Nearly all the vegetable material found was in the stomachs of specimens that were caught with a seine in Lake Creek, just a short distance above Upper Lake. It consisted, for the most part, of pieces of the small roots of the willows growing along the creek, and was probably taken by accident.

Needham (1901) states that *Chironomus*, *Corethra*, and Trichoptera were the most important food elements found in the brook trout he examined. In this case, however, the four chief elements of animal food, named in the order of their importance, were Hymenoptera, Coleoptera, Orthoptera, and *Chironomus*.

Fry.—Twenty-six specimens of fry were obtained from Lake Creek in August, 1902. They were too small to be positively identified, varying in length from ⅞ to 1¼ inches (2.2 to 3 centimeters). The stomachs of all except one contained food, but it was found to be in such condition that very little of it could be recognized.

Contents of stomachs of 26 fry.

Food elements.	Number of specimens in which found.	Average per cent of element.	Food elements.	Number of specimens in which found.	Average per cent of element.
Ephemerida (nymphs)	1	50	Diptera	5	72
Orthoptera	1	60	Chironomus (larvæ and pupæ)	5	22
Lepidoptera (moths)	2	40	Insect fragments	23	80

SUMMARY AND DISCUSSION OF RESULTS.

The following table shows the average per cent of the different elements composing the stomach contents of all the trout examined. The percentages given for each species were obtained by dividing the sum of the per cents of the different food elements by the number of stomachs containing food.

	Land-locked salmon.	Green-back trout.	Rainbow trout.	Small brook trout.	Large brook trout.	Fry.
Mammal remains			0.04			
Fish remains	36.84	4.40	26.55		1.48	
Araneida (spiders)			.10		.80	
Hydrachnidæ (water-mites)					.46	
Ephemerida				22.61	.54	2.00
Odonata			.50			
Plecoptera				.86		
Orthoptera		6.55	.12	1.55	3.80	2.40
Hemiptera		.20	.27		.87	
Neuroptera					.16	
Trichoptera	10.00	.16	.18		.72	
Lepidoptera	2.11	9.20	3.46	.69	1.18	3.20
Diptera	5.53	13.95	2.93	11.60	2.00	14.40
Chironomus (larvæ, pupæ)	.11	2.80	1.17	7.60	3.75	4.40
Simulium (larvæ)	5.26		1.93	6.48		
Coleoptera	15.31	16.68	7.75	.17	5.40	
Hymenoptera	1.06	1.52	1.18		9.15	
Insect fragments	1.51	23.44	31.70	48.10	31.10	73.60
Crustacea	.27	16.90	5.62		.07	
Mollusca	.06		.38			
Vegetable débris	13.05	4.20	8.70	.34	36.05	
Sand and gravel	8.83		7.47		2.47	

Twenty-two items appear in the above table, and all except one (sand and gravel) may be regarded as sources of nourishment. While much of the vegetable matter had no food value and was probably taken largely by accident, still, in a considerable number of cases, it was digestible material which would afford nourishment, and was present in such quantities as to indicate that it had been eaten purposely.

The table shows that there was considerable difference in the diet of the different species. The landlocked salmon (*Salmo sebago*) had partaken of 12 out of the 21 items of food; the greenback trout (*S. stomias*) 12; the rainbow trout (*S. irideus shasta*) 17; small brook trout (*Salvelinus fontinalis*) 10; and large brook trout 16. Thus the rainbow had the greatest variety in its diet.

The mammal remains consisted chiefly of the bones of a small mammal, apparently a mouse, eaten by a rainbow trout.

These four species of trout differed very widely in the relative amount of fish consumed. The landlocked salmon had partaken most freely, fish remains constituting an average of more than 1-third of the stomach contents; the rainbow trout ranked second in this respect; while the brook trout had eaten most sparingly of this kind of food. It is interesting to note in this connection, however, that all the fish remains that could be identified were found to be young suckers.

The last table shows how important insects are in the food of these trout during the summer. On an average, they constituted 40.9 per cent of all the material found in the stomachs of landlocked salmon; 74.5 per cent in greenback trout; 50.1 in rainbow trout; 99.6 in the small brook trout; and 58.6 in the large brook trout. The fry that were examined were entirely dependent on insects for their food. With the exception of the small brook trout and the fry, the insect material found in the specimens consisted chiefly of such forms as fell into the water accidentally. In view of this fact, and also in view of the dietetic importance of these insects, a study of the food of these trout during the long winter period when the lakes are covered with ice would be very interesting, as well as necessary to a good understanding of their food habits. The winter period is, undoubtedly, the most critical for them so far as food is concerned. That food was sufficiently abundant during the summer was shown by the good physichal condition of the trout, and by the quantity of fat that was found in most of them.

The rainbow and the large brook trout had the greatest variety of insect diet. Each had partaken of 10 of the 13 items listed, while the greenback trout had partaken of 8 and the landlocked salmon 7. Not more than three or four forms of insects, however, played an important rôle in the food supply of any species of trout. Named in the order of their importance, Coleoptera, Trichoptera, Diptera, and *Simulium* constituted by far the greater bulk of the recognizable insect food of the landlocked salmon, the four together making up an average of 36.1 per cent of the stomach contents in all the specimens. Coleoptera, Diptera, Lepidoptera, and Orthoptera were the important insect elements in the food of the greenback trout, and together constituted 46.3 per cent of the stomach contents. The rainbow trout had eaten most freely of Coleoptera, Lepidoptera, and Diptera, but these three made up only 14.1 per cent of the stomach contents.

A comparison of the results obtained for the small and the large brook trout shows that they differed greatly in their insect food. The small ones fed freely on May-fly nymphs and on the larvæ and pupæ of *Chironomus* and *Simulium*. Adult Diptera ranked second in importance, however, being exceeded only by the May-fly nymphs. These four groups together made up a little over 48 per cent of the food of these specimens. Hymenoptera, Coleoptera, Orthoptera, and *Chironomus* formed the most important part of the insect food of the large brook trout, and together constituted 22.1 per cent of the stomach contents.

Diptera, *Chironomus*, and Lepidoptera were the most important elements of the food of the trout fry. The Ephemerida were represented almost entirely by nymphs, and the Trichoptera by larvæ. The Lepidoptera consisted almost entirely of moths, and by far the greater part of the Hymenoptera were ants. The high percentages of Coleoptera were undoubtedly due, in a great measure, to the resistance of the chitinous elytra and other coverings to the process of digestion.

Examination of some trout from streams in the region of Mount Whitney, California, revealed the fact that in those waters also only a few forms of insects were an important part of the trout food. In 12 specimens obtained from the South Fork of the Kaweah River, the three most important elements of the food, which consisted entirely of insects, were chironomid larvæ and pupæ 15 per cent, Coleoptera 15, and trichopter larvæ 11.2. In 6 trout from Soda Creek, the most important elements were as follows: Trichopter larvæ, 30.8 per cent; Plecoptera, adults and nymphs, 9.2; and Orthoptera, Coleoptera, and Hymenoptera each 4.1 per cent. In 41 specimens from Little Kern River, Coleoptera and Hymenoptera were each 15 per cent of the food. The following percentages of insect food were obtained for 18 specimens of the golden trout (*Salmo roosevelti*) from Volcano Creek: Plecoptera (adults and nymphs), 12.2; Trichoptera (adults and larvæ), 7.2; ephemerid nymphs, 7.

Thirty-three specimens of Twin Lakes trout in all had eaten Crustacea. Of this number, 26 had eaten only *Daphnia*, 1 had eaten only copepods, 4 had eaten both *Daphnia* and copepods, and 2 had eaten only *Gammarus*. The insignificance of *Gammarus* as an element of food was rather surprising, as it was abundant in both lakes.

The vegetable matter that was found in the various stomachs consisted of such things as small pieces of wood, spruce leaves, seeds and seedpods of land plants, roots, *Potamogeton* leaves, and algæ. It seems probable that most of the sand and gravel was taken by accident. Much of it was, no doubt, derived from the cases of some of the trichopter larvæ. Judging from the difference in the percentages of sand and gravel, it seems that the landlocked salmon and the rainbow trout feed on the bottom much more extensively than either the greenback or the brook trout.

PLANKTON CRUSTACEA AS FISH FOOD.

It is frequently stated that the Entomostraca are very important factors in the food of many fishes, but we have very little definite information as to the kinds, the relative proportions, or the numbers of these small crustaceans eaten by the different fishes. It is known, of course, that plankton crustacea are an important element of the food of some fishes, such as the whitefish and herring, but here, even, we know little of the relative importance of the different Entomostraca. There is likewise great need of extending our knowledge as to the importance of these minute crustaceans in the diet of fishes that are not regarded as plankton feeders; and in spite of the emphasis that has been laid on the fact that they are of supreme importance to fish fry, here, too, definite information is by no means as extensive as it should be. A brief summary of some of the results obtained by several observers is given below.

Knox (1834) observed that the vendace (*Coregonus*) fed exclusively on microscopic animals of the class Entomostraca. Baird (1857) mentions the fact that "delicate little crustaceans" were found in the stomachs of Loch Leven trout (*Salmo fario levenensis*), of the charr *Salmo salvelinus*, and of the vendace (*Coregonus willughbii*). The crustaceans mentioned in this connection are *Daphnia*, *Bosmina coregoni*, and *Cypris*.

Jardine (1857) states that stomachs of the vendace (*Coregonus*) were found filled with Entomostraca. In speaking of the food of the trout in Loch Leven, Francis (1868) says that large quantities of Entomostraca were often found in their stomachs. Smith (1874) found *Daphnia* in the stomachs of six specimens of *Coregonus albus*. Barfurth (1874) found microscopic Entomostraca in the stomachs of *Alosa vulgaris*.

Between 1878 and 1888 Forbes made a careful study of the food of many Illinois fishes. He examined young belonging to 12 families and 26 genera, and found that the representatives of only one genus had not been feeding more or less extensively on Entomostraca. In examining both young and adults, he found that specimens belonging to more than 50 genera, representing 16 families, partook of Entomostraca during some period of their lives. He also states (1893) that two specimens of young trout taken at the mouth of Bridge Creek, Wyoming, had been feeding on *Polyphemus pediculus* and *Daphnia pulex*.

Ryder (1881) says that the food of young shad consists almost entirely of very small crustaceans, in reality for the most part Daphnidæ and Lynceidæ. In speaking of the adult shad, he states that he found a large quantity of a copepod, apparently a *Cyclops*, in the stomach of a spawning female. He says that there were probably a hundred thousand of these copepods in the stomach.

Brook (1887) found that very young cod and saith fed almost entirely on copepods. Brook and Calderwood (1886) state that copepods supply the principal food of the herring during the summer months, and ostracods were found occasionally.

Frič and Vávra (1894 and 1901) found plankton Crustacea in the stomachs of several species of fresh-water fishes.

Herdman (1894) states that by far the most important constituent of the food of young plaice (*Pleuronectes platessa*) seems to be the Harpacticidæ, especially the species *Jonesiella hyænæ*. Records for nearly 900 specimens show that sizes of about an inch (2.5 centimeters) in length live mainly on Copepoda. He also found that copepods form a part of the food of specimens 3 inches (7.5 centimeters) or more in length. Herdman and A. Scott (1895) state that after the larval marine fishes which they studied have absorbed the food supply stored up in the yolk-sac they pass to the stage in which copepods form their chief food. In his investigations on Lake St. Clair, Reighard (1894) found that Daphnidæ and Copepoda were eaten by various fish larvæ and the lake herring. Peck (1894 and 1896) found ostracods in the stomachs of menhaden and copepods in the stomach of a scup. In speaking of his investigations on the Great Lakes, Ward (1896) says that the smaller forms of crustaceans are eaten by the fish fry directly, and are sometimes the immediate food of the larger fishes.

Walter (1895–1899) obtained some interesting results in this respect in his studies of the food of fishes. I have not seen his own statements concerning these results, but Steuer (1901) says the following of them: "Nach den Untersuchungen E. Walter's können wir den Satz aufstellen, dass ganz allgemein die Menge des vorhandenen thierischen Planktons direkt proportional ist der Menge der in dem Teiche überhaupt vorhandenen Fischnahrung. Die Gesammtproduction an thierischen Plankton steht somit in geradem Verhältniss zum Zuwachs der Fische, d. h. je mehr Plankton, desto grösser der Zuwachs, je weniger Plankton, desto geringer der Zuwachs."

In describing an observation made on Lake Mendota, Wisconsin, Birge (1897) says that "The surface water was crowded with *Daphnia*, and an immense number of perch were feeding on them."

Scourfield (1898) states that three specimens of the three-spined stickleback (*Gasterosteus aculeatus*) and three roach (*Leuciscus rutilus*) which he examined had been feeding extensively on several forms of Entomostraca. Huitfeldt-Kaas (1898) found 50,000 *Bosmina* in the stomach of a *Coregonus lavaretus*. He says that *Bythoreptes longimanus* was the usual species found in the stomachs of trout and *Coregonus*, and next came *Bosmina obtusirostris* and *Daphnia galeata*.

Nordgaard (1900) says that *Calanus finmarchicus* constitutes the main part of the food of the herring along the coast of Norway, and also (1905) that the ostracod *Cypridina norvegica* was found to constitute part of the food of the cod (*Gadus callarias*).

T. Scott (1901) notes that the smaller crustaceans (schizopods, amphipods, and copepods) form a very important part of the food of the young marine fishes which he studied. Steuer (1901) found that 39 specimens of fresh-water fishes, varying in length from 5.5 to 13.5 centimeters and belonging to five different species, had partaken more or less freely of plankton crustacea. He found that a specimen of *Scardinius erythrophthalmus* 7 centimeters long had eaten 2,000 to 3,000 *Chydorus sphæricus*, and a slightly larger *Carassius* (Karausche) about 5,000 *Acroperus harpæ*. Needham (1903) notes the presence of *Daphnia* in the stomachs of two brook trout out of 25 which he examined. Kofoid (1903) found that the annual production of plankton and the output of the fisheries of the Illinois River show some correlation in their changes from year to year.

Considered with respect to whether plankton crustacea form any part of their food supply at any stage of their existence, trout readily fall into two groups, resulting from differences in habitat. The one group includes the trout that live in mountain streams. They can not depend upon these minute crustaceans for a supply of food because the waters of these streams are generally too wild and rapid for the development of plankton life. Occasionally, of course, there may be favored localities where pools are quiet enough for the growth of such organisms, but these are rare. The fry of trout which regularly inhabit lakes, but which ascend streams to spawn, must depend upon some other source of food while they are in the streams. This was well illustrated by the fry obtained in Lake Creek, whose food consisted entirely of insects. The other group is composed of trout that inhabit lakes. Here the conditions are favorable for the development of plankton organisms, and the trout may draw upon the plankton crustacea for food. That these crustaceans may form an element of the food of some trout for a considerable period of time is shown by the fact that they were found in stomachs of specimens that had reached a length of 12 to 15 inches (30.5 to 38 centimeters). It seems a little strange that trout of this size should be able to obtain such large numbers of these small crustaceans with an apparatus apparently so very poorly adapted to procuring such minute organisms.

The investigations relating to the food of marine fishes show that copepods are by far the most important element of the entomostracan part of their food, the Cladocera being negligible. Almost the reverse of this, however, was found to be true of the trout of Twin Lakes. Out of 31 specimens that had eaten Entomostraca, 26 had eaten only Cladocera (*Daphnia*), 1 only copepods, and 4 both *Daphnia* and copepods. In the four instances in which both had been eaten, the *Daphnia* constituted thirteen times as much of the stomach contents, on an average, as the copepods. Huitfeldt-Kaas (1898) says concerning his results, "Im Ganzen genommen die Daphnien viel häufiger in dem Fischemagen anzutreffen als die Copepoden." He thinks the explanation of this lies in the fact that the Daphnidæ, with their slow, regular movements, are more easily obtained than the copepods with their irregular, jumping movements. Steuer (1901), however, thinks that the predominance of Cladocera is due chiefly to their greater size, and secondly to their greater abundance. It is true, of course, that the copepods found in Twin Lakes are more powerful swimmers than the *Daphnia*, and are more irregular in their movements, so that it would be more difficult for the trout to capture them. It is also true that *Daphnia* are slightly larger than the copepods, and for this reason could be more easily obtained, while, also, the latter, being long and slender, would be more likely to pass through the straining apparatus of the trout. The differences in size and shape would be particularly effective in permitting the copepods to escape from the larger trout, which have a rather coarse straining apparatus.

With respect to size, however, it may be said that the only Entomostraca represented in the food of some specimens of *Salmo henshawi* from Lake Tahoe were two species of *Daphnia*, while the large copepod *Epischura nevadensis* was found to be more abundant in the lake at the time than *Daphnia*. So far as size is concerned, therefore, it would seem that this copepod could be obtained by the trout as easily as the *Daphnia*. As to the point that the Cladocera are more abundant, it is only necessary to say that adult copepods were nearly as abundant in Twin Lakes in 1902 as *Daphnia*, and were more abundant in 1903. Also, at the time of the above observation on Lake Tahoe in 1904, the copepods were much more abundant than *Daphnia*.

There is some doubt, however, as to whether the very great predominance of *Daphnia* over copepods in these instances is fully accounted for by the three factors that have been considered—namely, differences in movement, size, and shape. But no other factors were apparent. It was thought, at first, that possibly small swarms of *Daphnia* might contribute to the explanation, but no evidence whatever of any unusual aggregations of these was found. A single catch of trout will serve to show, still further, the striking difference in the rôle played by these two forms of Crustacea as sources of food. Ten rainbow trout whose stomachs contained Entomostraca were caught in the pool below the dam in the outlet canal of Twin Lakes within an hour one afternoon. Of this number 9 had eaten only *Daphnia*, while the tenth had eaten both copepods and *Daphnia*. The specimens were all about the same in size—6 to 8 inches (15 to 20 cm.)—so that their straining apparatus should have been equally effective. Since one trout was able to secure copepods, and it was one of the larger specimens, it hardly seems probable that the other nine were unable to secure them also, either on account of the irregular movements, the small size, the slender form, or the scarcity of the copepods, as these were more abundant than *Daphnia* in the water that was flowing into the pool.

From what has already been said, it will be seen that many species of fish are important factors in the destruction of plankton crustacea. Hence, this fact must be taken into account in a quantitive consideration of this element of the plankton of a body of water inhabited by these fishes. Immense numbers of minute crustaceans are destroyed by the trout in Twin Lakes. One greenback trout 12 inches (30 centimeters) long had eaten 4,500 *Daphnia;* another 14 inches (35 centimeters), 2,250, and the stomach of a rainbow trout 15 inches (38 centimeters) long contained 1,300. Over 16 per cent of the greenback and rainbow trouts whose stomachs contained food, had eaten *Daphnia*, the number eaten by each individual varying from about 50 or 75 up to 4,500. When it is considered that these figures represent the number consumed by each trout at a single meal, and also that the lakes were well populated with these two species of trout, we can see how enormously they affect the numbers of Daphnias. In this connection it is interesting to note also that the stomach of a 15-inch Tahoe trout (*Salmo henshawi*) which was examined during the summer of 1904 contained 1,700 Daphnias, about two-thirds of which were *D. hyalina* and one-third *D. pulex*. The above numbers, moreover, do not represent the entire drain upon these small crustaceans. The great majority of the adult females had either eggs or developing embryos in their brood chambers. Whether the eggs are destroyed during their passage through the alimentary canal or not is still an open question. Frič and Vávra (1894) found that summer eggs sometimes pass through the canal undigested, but they did not determine whether these eggs had lost their vital power. Steuer (1901), however, raised a *Ceriodaphnia* from an ephippium which was taken from the intestine of a fish. But, even if the majority of the eggs escaped digestion and developed afterwards, it hardly seems probable that the embryos escaped also, and they alone represented a very large additional loss.

Steuer (1901) calls attention to the likelihood of overestimating the value of Entomostraca as a direct source of food for fishes. He thinks that, in very many cases, they enter the digestive tract of the fish only indirectly; that is, after being eaten by some animal which is in turn eaten by the fish. There was no room for doubt as to their being eaten directly by the trout in these cases. In a number of instances there was nothing else in the stomachs; and in stomachs which contained additional food the additional food in most instances consisted of insects that had accidentally fallen into the water, and these of course had not been feeding on Entomostraca.

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HAWAIIAN CIRRIPEDIA.

By HENRY A. PILSBRY, Sc. D.
Special Curator, Department of Mollusca, Academy of Natural Sciences of Philadelphia.

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BY HENRY A. PILSBRY, Sc. D.
Special Curator, Department of Mollusca, Academy of Natural Sciences of Philadelphia.

In the course of dredging and trawling in Hawaiian waters during the summer of 1902, the steamer *Albatross* obtained a varied and interesting series of cirripedes, which are described in the following pages. With the exception of a single species of *Balanus* all the specimens were taken at depths of from 60 to 800 fathoms, most of them from between 200 and 300 fathoms.

The shore cirripedes of the islands are still practically unknown, only a few scattered records appearing in the monographs of Darwin and Gruvel.

Cirripedes have a practical importance chiefly from the prolific growth of the shore forms on all submarine objects, *Balanus*, *Conchoderma*, and *Lepas* largely composing the growths fouling ships' bottoms, buoys, etc. Since most forms do not penetrate wood, such growths are not permanently injurious, but are deleterious mainly from the expense attending their removal from time to time. They are almost as profuse upon metal as upon wooden bottoms, and have even been found on the screws of steam vessels.

In some places the larger forms of *Balanus* are eaten, the flesh resembling that of the lobster. There is good reason to believe that the larger species of the Pacific coast, such as *Balanus aquila*, *B. evermanni*, and the large *Balanus* found near Port Townsend, Washington, would afford a valuable addition to our resources of sea food, if they can be obtained in sufficient quantity.

The deep-water cirripedes are very abundant in many places, but no data are available to show to what extent they are eaten by fishes. They probably form an important item in the food supply of bottom-feeding forms.

LEPADIDÆ.

Scalpellum hawaiense n. sp.

[Pl. IV, fig. 1-2.]

A species of the group C′ of Gruvel's arrangement, the 14 valves being wholly calcified, the carina regularly curved and a rostral plate present. There is no subcarina. The capitulum is ovate, the anterior and posterior outlines about equally curved. The plates are covered with a thin pale olive-buff cuticle, and are all sculptured with fine cords radiating from the apices and more or less knotted or beaded by the intersection of the lines of growth.

Scuta with convex occludent and concave tergal margins, the lateral and basal margins straight. The anterior and lateral faces of the plate are about equal in area, and are separated by an arcuate diagonal angulation. Anteriorly the radial striation is finer.

Terga large and rhombic, with erect apices. The occludent margin is straight, the carinal margin straight above but convex where in contact with the carina. The scutal margin is nearly straight. The carina is extremely broad basally, the roof convex, the lateral angles prominent. It is curved throughout, but the upper half more so; apex terminal.

The upper lateral plate is triangular, with apical nucleus. Its scutal margin is longer than either of the other two, which are subequal. The rostrum is an excessively small, very narrow plate, visible below the apices of the rostral latera. The rostral lateral plates are low, obliquely triangular, with the apices contiguous at the median ventral line. The lateral edge is covered by the imbricating rostral margin of the inframedian lateral plate. The inframedian lateral plates are triangular, nearly equilateral, with apical umbo. The carinal lateral plates are subtriangular, embracing the lateral angles of the carina; their apices are recurved and project slightly. The peduncle is covered with horizontal, somewhat imbricating, smooth scales, which are rather sparsely tomentose, the hairs very delicate and rather long. Its total length is unknown, as the individual has been removed from its support by cutting the peduncle.

Length of capitulum 25, greatest breadth 16 mm.; greatest thickness, across the carino-lateral plates, 12 mm. Length of carina 21.5, diameter at base 9.5 mm.

Type, no. 32416 U. S. National Museum, from *Albatross* station 4181, near Kauai, in 811 fathoms, bottom manganese sand and globigerina ooze.

Scalpellum rubrum Hoek, from near Luzon, agrees with *S. hawaiense* in the proportions of the valves, but it differs strikingly in color and surface sculpture. *S. hirsutum* is also related, though obviously different.

Scalpellum pacificum, n. sp.

[Pl. IV, fig. 3, 4.]

A form closely related to *Scalpellum australicum* Hoek.

The capitulum is acutely ovate, compressed, composed of 14 valves closely juxtaposed; these are covered with a very thin brownish film, which near the occludent margin bears a few scattered long hairs. The valves are sculptured with numerous, but not crowded, radiating threads, and on each of the side valves there is one more prominent ridge or angle extending from the umbo to the opposite margin, dividing the valve into two areas.

The scutum is convex, divided into two nearly equal areas by a slightly curved diagonal rib; the occludent and opposite lateral margins are slightly arcuate, the tergal and basal margins straight, the latter at an angle of 90 or a trifle less with the occludent border.

The tergum is larger than any other plate, triangular, with a distinct diagonal rib parting the narrow carinal from the large and triangular anterior area. The occludent margin is convex, the carinal a little undulating and the tergal or basal margin straight. The apex stands erect.

The carina is simply arched, with the flat roof bordered by distinct ridges; sides at about right angles with the roof, and broader near the upper extremity of the valve.

The upper lateral plate is trapeziform with the apex superior, the scutal margin concave, the basal and tergal margins equal, straight, and the very short carinal margin also straight.

The rostral lateral plate is subquadrate, short and broad, the length being about half the width. The curved beaks are connate on the occludent border above the rostrum, and do not project perceptibly. The upper and lower borders of the plate are subparallel and straight; the rostral border is concave. From the umbo a curved rib runs to the posterior basal angle. The rostrum is rudimentary, merely a linear trace.

The inframedian lateral plate is extremely narrow, linear, wedge-shaped, the narrow apex above. There is a low cord along each edge, and the apex is curved rostrad.

The carinal lateral plate is irregularly trapezoidal, with the umbo projecting a little beyond the carina. The carinal margin is straight; upper margin very oblique, straight; lateral margin short, straight. In carinal aspect, the two carinal latera appear as contiguous tricostate brackets under the two lateral ribs of the carina. The peduncle is short, wider above, covered with wide low scales, about seven scales in any longitudinal row.

Length of capitulum of type, from station 3907, 16.5 mm., greatest breadth 8.5 mm., diameter 3.8 mm.; length of peduncle 3.5 mm.

Length of capitulum, specimen from station 3824, 12.5 mm., width 6 mm.; length of peduncle 2 mm.

Type no. 32419, U. S. National Museum, from *Albatross* station 3907, south coast of Oahu, 315 fathoms, on the spine of a cidaroid sea-urchin, with *Pœcilasma;* bottom fine white sand and mud. Specimens also from station 3824, south coast of Molokai, 222 to 498 fathoms, on *Hyalonema;* bottom of coral rock and broken shell.

This species is more closely related to *S. australicum* Hoek[a], than to any other known form. It differs from that in the sculpture of the valves, each having a stronger diagonal ridge, and in the shape of the plates of the basal whorl, especially the rostral latera, which in the *Challenger* species are as high as wide. The inframedian and carinal latera also differ in several respects, and the umbo of the upper lateral plate does not imbricate over the scutum as it does in *S. australicum. Scalpellum hirsutum, S. tenue,* etc., are also allied species, but are clearly distinct by various characters.

Trilasmis eburneum Hinds.

Trilasmis eburnea Hinds, Voyage of the Sulphur, vol. I, Mollusca, p. 72, pl. 21, fig. 5, 1844.

Pœcilasma eburnea Darwin, Monograph on Cirripedia, p. 112, pl. 2, fig. 5, 1851. Gruvel, Monogr. des Cirrhipèdes, p. 120, fig. 139 (copied from Darwin), 1905.

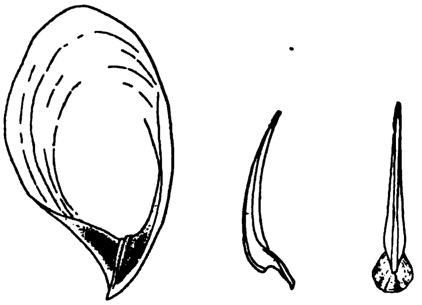

FIG. 1.—*Trilasmis eburneum.* Scutum and two views of carina.

Albatross station 3845, south coast of Molokai in 60 to 64 fathoms, on spines of a *Cidaris*-like sea-urchin.

This rare species has been known hitherto only from specimens taken sixty years ago by the *Sulphur* on the coast of New Guinea. They occurred on the spines of an "*Echinus.*" The Hawaiian specimens differ from them in being a little larger, the capitulum 3.4 mm. long, and slightly unlike in the shape of the carina, the upper part of which is more attenuated, while the basal cup is more flattened. While this variation is probably of no great importance, I have deemed it well to figure the scutum and carina of a Hawaiian individual.

Pœcilasma kæmpferi Darwin.

Pœcilasma kæmpferi Darwin, Monogr. Lepadidæ, p. 102.

Albatross station 3984, between Honolulu and Kauai, 164 to 237 fathoms. Station 3839, south coast of Molokai, 259 to 266 fathoms. Station 3884, Pailolo Channel, 284 to 290 fathoms. Station 4117, northwest coast of Oahu, 282 fathoms. On the crab *Cyrtomaia smithi* Rathbun. Also stations 3811, south coast Oahu, 338 fathoms, and 4045, west coast Hawaii, 198 fathoms, on *Lambrus* (*Platylambrus*) *stellatus* Rathbun.

The species was originally described from Japan, attached to the crab *Inachus kæmpferi* De Haan. It is new to the Hawaiian fauna. A very similar form, *P. aurantia* Darwin, occurs at Madeira, and by some authors has been considered to form merely a variety of the Japanese *P. kæmpferi.*

If *Pœcilasma* is to be allowed to stand distinct from *Trilasmis,* it will be for species of the type of *P. kæmpferi,* most of which are cancericoles.

Pœcilasma bellum, n. sp.

[Pl. IV, fig. 6.]

The capitulum is elliptical, acute at both ends, and composed of five wholly calcified valves in close contact. White or flesh-tinted by the viscera showing through. The occludent and carino-tergal outlines are equally convex. The margins of the peduncle foramen flare laterally.

The scutum is very large, convex, its surface divided by a prominent angle passing in a curve from the beaks to the angle at the junction of carina and terga. The basal and occludent margins form a single symmetrical curve, the basal making no angle with the occludent. The carinal margin is convex and the tergal straight. The plate has a dense and minute sculpture of fine radial lines which are irregular or divaricating, and a coarse sculpture of well-spaced wrinkles and furrows, parallel to the growing margins of the valve. The furrows and riblets are more emphatic in the baso-carinal area of the scutum, being crowded there into a strong corrugation. Inside there is a single massive tooth, bifid at its summit, under the umbo in each valve.

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[a] Challenger Report, vol. VIII, Cirripedia, p. 118, pl. V, fig. 11.

The tergum is wedge-shaped, closely corrugated parallel to its scutal border, but with two rounded, contiguous ribs running along the opposite or outer border. The apical angle is less than 90°. Inside smooth, with a minute tooth at the scutal margin of each tergum near the occludent end.

The carina is narrow distally, but from the middle down it widens rapidly, the sides becoming much broader and at the same time flaring laterally. They are corrugated parallel with the scutal margin. The roof of the carina is very narrow throughout, widening gradually and slightly upward and with a median hollow or furrow. Inside there is a massive transverse septum at the lower two-fifths of the carina, rising in a blunt articulating tooth at each side.

The peduncle is very short, cylindric, circularly wrinkled, covered with a tough flesh-colored integument.

Capitulum, total length 14.5, breadth 6.4, diameter 3 mm. Scutum, length 11.7, breadth 5.7 mm. Tergum, length 6.2, breadth 2.2 mm. Carina, length 10, breadth 2, diameter 2 mm. Length of peduncle 2 mm.

Albatross station 4117, northwest coast of Oahu, 241 to 282 fathoms, bottom of coral sand and foraminifera, in copious numbers on large spines of a sea urchin. Also station 4117, 253 to 282 fathoms, in nearly the same place. South coast of Oahu, 315 fathoms, fine white sand and mud. Station 3998, vicinity of Kauai, 228 to 235 fathoms. Stations 4090, 4097, 3883, and 3866, Pailolo channel, between Maui and Molokai, 277 to 304 fathoms, bottom of fine gray sand and globigerina ooze. Station 3839, south coast of Molokai in 259 to 266 fathoms.

In the straightening out of the basal margin to bring it parallel to the occludent edge, *P. bellum* is like *Megalasma striatum* Hoek. The system of sculpture, the very short peduncle, the internal ridge across the cavity of the carina, and the situs on sea-urchin spines are also features approximating *Megalasma;* but that genus differs by the slightly higher position of the umbo of the scutum, on the occludent margin, and the much broader crest of the carina. On the whole, *P. bellum* may be said to stand intermediate between *Pœcilasma carinatum* and *Megalasma*. *Pœcilasma bellum* is an abundant species on fine sand bottoms throughout the Hawaiian group, always seated on large *Echinus* spines, frequently sharing them with *Alepas*. It is a handsome little barnacle, very constant in all its features.

Dichelaspis hawaiensis n. sp.

[Pl. IV, fig. 5.]

The capitulum is much compressed, unsymmetrically long ovate, supported on a nude peduncle half the length of the capitulum or shorter. The valves are in contact only at their ends. The general integument is smooth.

The scutum is L-shaped, the basal segment narrower than the occludent, the latter widening above to its oblique termination, and about twice the length of the basal segment. The tergum is irregularly triangular, with blunt apex, slightly concave and very long carinal margin, and with a notch near the occludent end of the scutal margin for the reception of the distal end of the scutum. An arcuate furrow runs upward from this notch. The carina is arcuate and extends upward well beyond the middle of the tergum. It is widest in the middle, and at the base is expanded in a biramose appendage clasping the top of the peduncle, which it half encircles. The peduncle is stout, cylindrical, and circularly wrinkled.

Length of capitulum, 6.5 mm., breadth 3.2 mm.

Type, no. 32409, U. S. National Museum, from Hawaiian Islands, collected by the *Albatross*, 1902, attached to a slender gorgonian.

This species is more closely related to *D. orthogonia* Darwin than to any other. It differs from that in the shorter basal portion of the scutum, the simpler shape of the tergum, and the more broadly clasping basal appendages of the carina. Unfortunately the station number was not preserved, so that the exact location can not be given.

ALEPAS Rang.

Nude, leathery forms, with a single filamentous appendage on each side, and a long, many-jointed caudal appendage. About a dozen species hitherto known are mostly from deep water.

The primary division of the genus should be into those forms which have the endopodite or both rami reduced on the fifth and sixth pairs of cirri, and those in which the rami are not reduced and are subequal in all. In *A. rex*, described below, the fifth and sixth endopodites are so specialized. In *A. percarinata* they are unreduced and subequal.

The forms taken by the *Albatross* were seated upon large sea-urchin spines and gorgonians on a bottom of fine sand and mud, such as sea urchins ordinarily inhabit.

Alepas percarinata, n. sp.

[Pl. IV, fig. 8.]

The capitulum is irregularly ovate, dorsally carinated, much longer than the slender peduncle, straightened on the occludent margin, without trace of calcareous or chitinous plates. Color pale brown.

The orifice is very small, not protuberant, less than half the length of the capitulum, with puckered lips. The dorsum is acutely carinated, the edge of the keel smooth. The surface is finely wrinkled transversely. The short slender peduncle is coarsely wrinkled, and sparsely warty, a few scattered warts also appearing on the adjacent base of the capitulum.

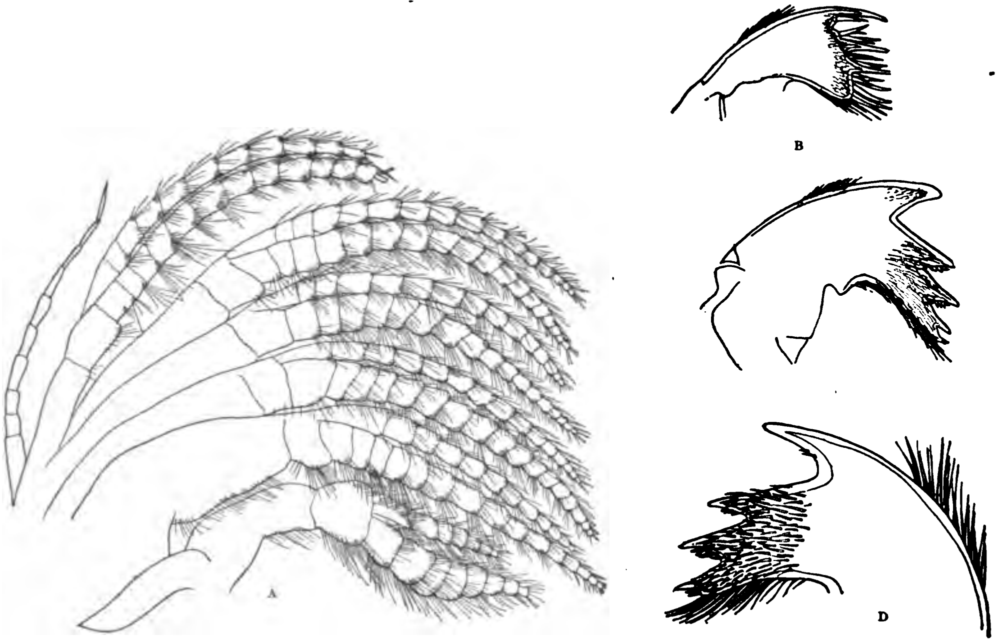


FIG. 2.—*Alepas percarinata.* A, Cirri of the left side; B, maxilla; C, mandible; D, mandible of specimen from station 3828.

Length of capitulum 9 mm.; breadth 7 mm., diameter 5 mm. Length of orifice 3 mm.; length of peduncle 4 mm., diameter 2 mm. (Cotype, station 4116.) Another specimen (station 3866): Length of capitulum 12.5 mm., breadth 10 mm., diameter 6 mm. Length of orifice 4 mm. Length of peduncle 5 mm., diameter 3-5 mm.

Mandible with three teeth and two spines at the lower extremity. The upper tooth is largest, the second about midway of the toothed margin; the third is more slender. The lower edges of the second and third teeth are denticulate by the projection of short colorless spines. The lower border of the mandible is densely pilose (fig. 2, C).

Maxillæ very irregularly spinose, the strongest spine at the upper edge, an irregular notch below it. There are two nearly as large in the median part (fig. 2, B).

The cirri (fig. 2, A) are rather short. The exopodites have 8, 15, 17, 18, 18, 14 joints in the first to sixth pairs of limbs, respectively, the endopodites being usually a little more slender and with 7, 14, 14, 15, 16, 12 joints. The caudal appendage is long and slender, composed of 13 long joints, with but few bristles (fig. 2, A). The penis is closely wrinkled and annulate, with a few bristles and a pencil of hairs at the tip.

Albatross station 3866, Pailolo Channel, between Molokai and Maui, in 283 fathoms, bottom of gray mud and fine sand. Also stations 4116 and 4117, northwest coast of Oahu, 241 to 282 fathoms, on bottom of coral sand and foraminifera; station 3839, south coast of Molokai, 259 to 266 fathoms, bottom of light brown mud and sand, everywhere on large *Cidaris*-like sea-urchin spines.

This *Alepas* belongs to the group having cirri with subequal rami. It is externally distinguished by the absence of plates in the integument, the small orifice and the acute dorsal keel. *A. pedunculata* Hoek, is perhaps the most nearly related form, differing by some details of the denticulation of the mandibles and maxillæ, by the absence of red spots dotting the capitulum, etc.

The oldest specimens lose the sharpness of the dorsal keel, and become plumper.

At station 3828 off the south coast of Molokai, 281 to 319 fathoms, broken shell bottom, a sea-urchin spine was brought up carrying two specimens of *Alepas* similar to *A. percarinata* except that they show no traces of a dorsal keel except close to the base of the capitulum. The latter is 4 mm. long—a size which in *percarinata* is very strongly keeled. The cirri and caudal appendage are as in *A. percarinata*, but the joints of the tailpiece bear pairs of bristles near the sutures. The mandibles (fig. 2, D) differ by showing no lower point distinct from the fourth tooth, the two sides being alike in this respect. The maxillæ scarcely differ from those of *A. percarinata*. The general agreement is so close that I am disposed to believe that the specimens may have lost their carinæ by accidental means; but if it be a normal form, a new species is indicated.

Alepas rex, n. sp.

[Pl. IV, fig. 7.]

A large species with irregularly ovate, obese capitulum, longer than the peduncle, straightened on the occludent margin, and without trace of calcareous or chitinous plates. Color pale ocher yellow, a little darker on the peduncle.

The orifice is slit about half the length of the capitulum, its lips a little crenulated, or irregularly warty; in adults they do not protrude. The ventral side is elsewhere rounded; the dorsum is marked by a low ridge or angle. The surface of the capitulum is irregularly pitted, somewhat wrinkled, and sparsely asperate with small warts, each with a brownish tip. The surface of the peduncle is much and deeply wrinkled transversely. It is cylindric, and expands basally to clasp the supporting surface. The dimensions of two individuals are given below:

	No. 1.	No. 2.
	mm.	*mm.*
Length of capitulum	21	22
Breadth of capitulum	20.5	19
Diameter of capitulum	16	15
Length of orifice	11.5	13
Length of peduncle	19	22
Diameter of peduncle	10	9

The mandibles (fig. 3, B, D) have two strong teeth and two much smaller, more slender ones at the lower extremity (fig. 3, B), or there may be three at the lower extremity (fig. 3, D), the two figured being from the right and left sides of the same individual.

The maxillæ (fig. 3, A) have a densely spiny edge, which is deeply excavated below the upper spine.

The cirri are long and graceful. The first pair is much shorter than the others, the rami broad, composed of about 32 and 17 joints, profusely bristly. The second pair has very long rami armed with very long spines, with some shorter ones around their bases (fig. 3, c), joints 58 to 61. The third pair is similar, with 72 and 70 joints. Fourth pair similar. Fifth pair with the rami very unequal, the exopod with 84 joints, the endopod slender and much shorter, with about 33 joints. The sixth pair is similar, exopod with 83, endopod with 30 joints (fig. 3, F). The caudal appendage is small, with 13 joints (fig. 3, F). The penis (fig. 3, E) is of the usual multi-annulate type, sparsely hairy.

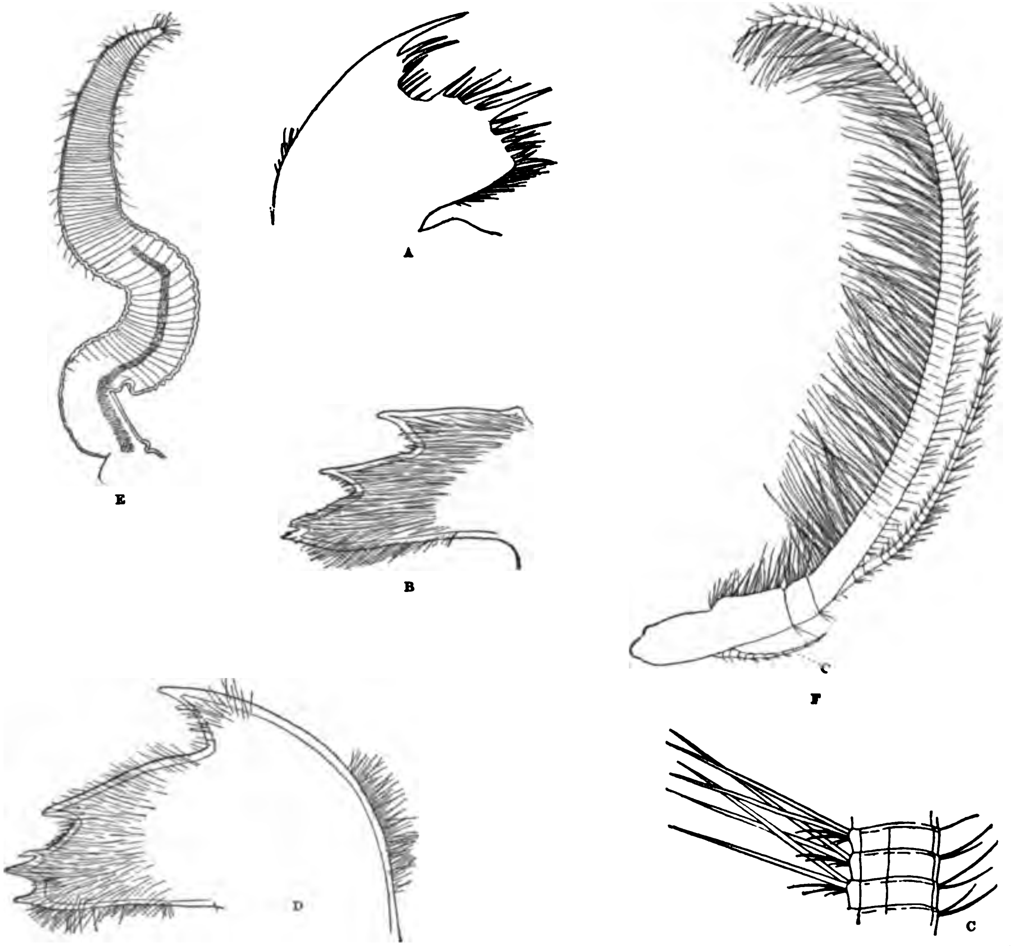


FIG. 3.—*Alepas rex.* A, Maxilla; B, D, mandibles; C, detail from 2d pair of cirri; E, penis; F, last cirrus and caudal appendage, ć.

Albatross station 3998, vicinity of Kauai Island, 228 to 235 fathoms, bottom of coarse broken coral, sand and shells. Specimens seated on dead stems of gorgonians.

Four adult specimens were taken on two gorgonia stems, each specimen surrounded by a group of young and larval individuals. The young are more strongly keeled than the adults, the keel being somewhat uneven. They are similarly beset with little warts. The mouth projects decidedly more than in the old specimens.

The cypris larvæ just attaching are about 1.5 mm. long.

VERRUCIDÆ.

Verruca halotheca, n. sp.

[Pl. IV, fig. 9, 10.]

Shell white, flattened above, with steep sides, almost perpendicular to the base of attachment, which has a rounded contour. Surface moderately corrugated with concentric growth ridges. Movable scutum small, flat, with an acute apex and three articular ridges, the middle one strongest. Movable tergum larger, quadrate, flat, with three strong imbricating articular ridges. Fixed scutum roughly quadrate divided by an oblique sulcus into two nearly equal triangles. Fixed tergum of very irregular shape, divided into three triangular areas; its umbo adjacent to that of the movable tergum, but not quite marginal. The carina articulates with the rostrum by means of three large and several smaller teeth, forming a zigzag suture; each tooth terminates a ridge. It articulates with the fixed tergum by a single tooth projecting into the tergum near the base. The rostrum is irregularly cone-shaped, minus a segment, in shape somewhat like the anterior valve of some chitons. It has several radiating ridges on the carinal side. Greatest rostro-carinal length at base 14 mm., at umbones 12 mm., breadth 12.5 mm. Height from base to apex of rostrum, fixed scutum or carina, 8 mm.

Length of the straight rostro-carinal hinge of the opercular valves 10 mm. Length of scutum from this line to umbo 5.5 mm. Length of tergum 6 mm.

Type, no. 32423 U. S. National Museum, from station 4060, northeast coast of Hawaii Island, in 913 fathoms, on a pebble of volcanic rock.

A single specimen of this large *Verruca* was obtained. It is clearly distinct from any of those described by Darwin, Hoek, or in Gruvel's recent monograph, though related to *V. trisulcata*, *spengleri*, etc. It is chiefly notable for the flat top, absence of salient umbones, and the generally inornate appearance. It is the largest *Verruca* yet described. A few detached valves of a small individual were taken at station 3998, vicinity of Kauai Island, in 228 to 235 fathoms, with *Catophragmus* and *Pœcilasma*.

CHTHAMALIDÆ.

Genus **CATOPHRAGMUS** Sowerby.

This genus has hitherto been known by two species: *C. imbricatus* Sowerby, from Antigua and *C. polymerus* Darwin from New South Wales, both of which are described in Darwin's monograph on the Balanidæ. The first, *C. imbricatus*, is a very rare barnacle. Both of the species are littoral, associated with or growing on *Tetraclita* and other shore forms.

A third species of the genus, from still another part of the world, is represented by certain mutilated individuals dredged by the *Albatross* near Kauai in about 230 fathoms. It is very distinct from the others by its well developed caudal appendage—that organ being absent in *C. polymerus*, very small in *C. imbricatus*. Moreover, the valves show many points of difference, and the mandibles, maxillæ, and cirri are unlike in various details.

Catophragmus darwini n. sp.

[Pl. V.]

General form of the animal uncertain, since it is known only by broken capitula, which are *Balanus*-like, made up of valves of dense and porcelain-like texture; white. There are at least three whorls of plates, the first whorl consisting of scuta and terga, the second of carina, latera, and rostrum, the third of imbricating basal plates.

The scutum (pl. V, fig. 7 outside, fig. 4 inside), is triangular, sculptured with rather widely spaced riblets parallel to the basal margin. The occludent and basal margins are straight. The tergal margin is somewhat convex, and on the apical half bears a projecting wing or articular ridge with serrate edge and closely grooved and costate surface. This wing projects into the articular groove of the tergum. Inside the scutum shows a beveled, obliquely costate and thick occludent border, a slightly reflexed apical area, and a series of fine sharp grooves running inward from the teeth at the free edge of the articular ridge or wing. The scar of the adductor muscle is not noticeable. The length of the scutum is 5.3 mm.

The tergum (pl. v, fig. 6 outside, fig. 8 inside) is triangular, sculptured like the scutum, but showing weak radiating striæ, also, and with a sharp ridge followed by a depressed band near and parallel to the scutal margin. The carinal margin is straight, the basal a little concave, and the scutal margin is slightly convex. The articular ridge projects far on the scutal side, sloping inward, and is about half as long as the scutal margin, from which it is separated by a deep articular furrow. Inside the apical and scutal margins of the valve and articular ridge are margined by a wide border sculptured with growth lines. Elsewhere the valve is smooth and white.

The carina (pl. v, fig. 1, 3) is shaped much like that of *Balanus*, or like the anterior valve of a chiton, since it surrounds the opercular valves behind and at the sides. Outwardly it is tripartite, with a median curved triangle (the "roof"), sculptured with about five unequal low radial ridges, and two flat lateral triangles; the whole being sculptured with wide-spaced grooves parallel to the basal margin and parted by flat intervals. The umbo is apical. The lateral borders are somewhat crenulated.

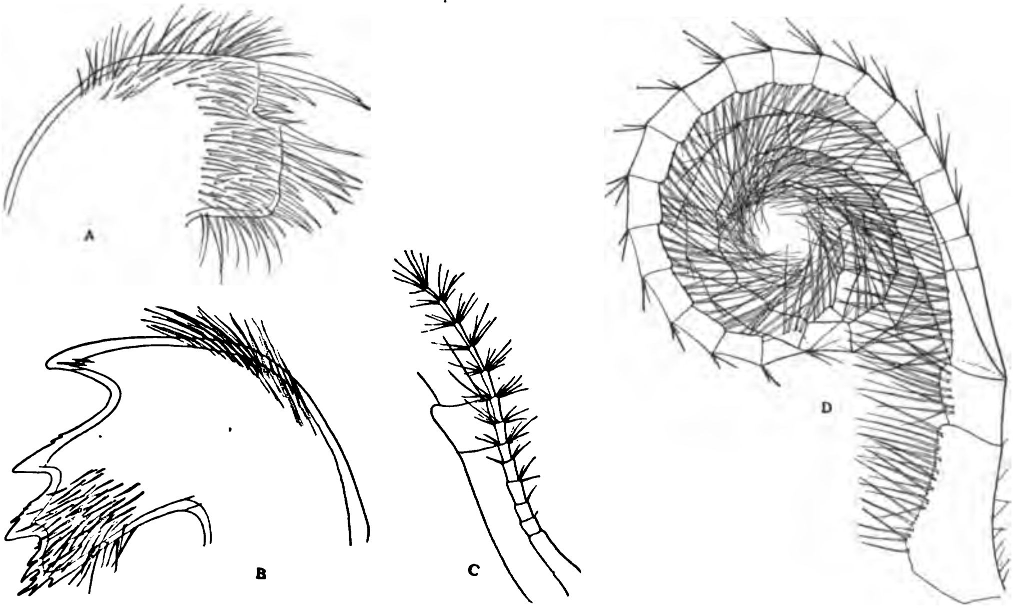


FIG. 4.—*Calophragmus darwini*. A, Maxilla; B, mandible; C, caudal appendage; D, fifth cirrus.

The carino-lateral plate (pl. v, fig. 1, Cl.) consists of a triangular, erect, radially six-ribbed area and a projecting ribless triangular wing on the occludent side above; the whole sculptured with spaced grooves parallel to the basal marign, becoming oblique on the wing.

The rostrum (pl. v, fig. 2, 5) resembles the carina in shape, but is smaller, with only three prominent radial ribs. The rostro-lateral plate (pl. v, fig. 2, Rl) is triangular, sculptured with four wide ribs and the usual spaced grooves parallel to the basal margin. The plates of the next lower or third whorl are small, subtriangular, and of three shapes, doubly winged (pl. v, fig. 2, lower left-hand plate), winged on one side (fig. 2, lower right-hand plate), or without lateral wings (fig. 2, intermediate plate). The base is unknown.

The mandibles (fig. 4, B) have three large teeth and a group of denticles at the lower extremity. The maxillæ (fig. 4, A) have the usual pair of strong spines above; the lower moiety of the margin projects beyond the upper, both being densely bristly. The first pair of cirri is much shorter than the others, with wider rami, each of 10 joints, densely bristly. The rami of the third pair have about 21 joints and are like those of the following cirrus. The posterior cirri have about 25 joints. The rami of each cirrus are subequal throughout and are much curled; they have small tufts at the articulations, and a continuous series of long spines along the concave side, about four pairs of spines on each joint (fig. 4, D, fifth cirrus). The caudal appendage is long and slender, of 13 joints (fig. 4, C). The penis is very long, perhaps longer than the longest cirri, and it is apparently not annulated. There is a tuft of hairs at the end and some sparse, short hairs along its length.

Type, no. 32407 (hard part) and no. 32408 (soft part) U. S. National Museum, from *Albatross* station 3998, vicinity of Kauai Island, in 228 to 235 fathoms, on bottom of coarse, broken coral, sand, shells, and rock; with *Pœcilasma bellum*, *Alepas percarinata*, and a few small odd valves of *Verruca halotheca*.

Fragments of two or three individuals were taken, the largest and most perfect being drawn in plate v, figures 1 and 2, in which the following plates are preserved in place: Carina (c), carino-lateral (Cl.), terga (T), scuta (S); and in another individual the rostrum (R), rostro-lateral (Rl), and four plates of the third whorl. Figures 3 (top view of carina) and 5 (anterior view of rostrum) represent detached valves of another individual or individuals.

BALANIDÆ.

Balanus amphitrite Darwin.

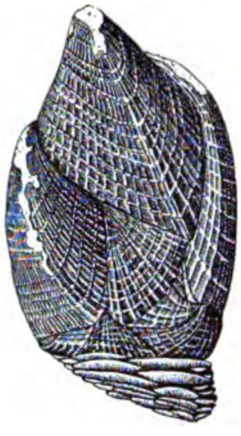
Balanus amphitrite Darwin, Monograph on the Balanidæ, p. 240.

Some small specimens taken from the bottom of a tug at Honolulu are similar externally to figure 2*e* of plate v of Darwin's Monograph, except that the compartments diverge less above, the aperture being somewhat smaller and hardly dentate. The basal length of the largest specimen is 15 mm. The terga resemble figure 2*k* of the same plate.

It is difficult to pronounce upon the subspecies or variety of *B. amphitrite* to which these specimens are referable. They are probably not full grown, and a much larger gathering would be essential for a satisfactory study of the Hawaiian race.

Balanus sp.

The tangles brought up numerous *Cidaris*-like spines encrusted with small barnacles 2 to 3 mm. in diameter, at station 4062, northeast coast of Hawaii, 83 to 113 fathoms. They are too young to be identified with certainty.



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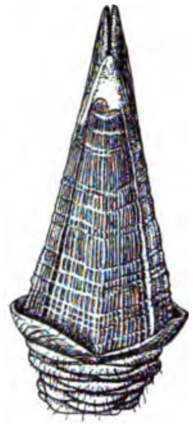

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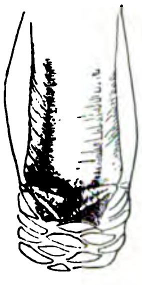

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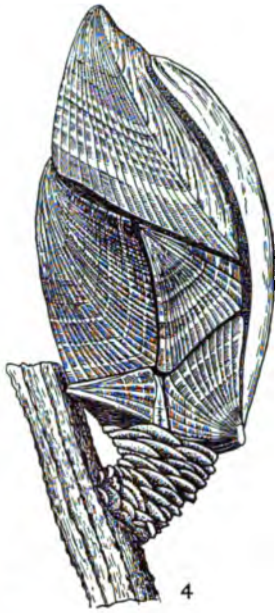

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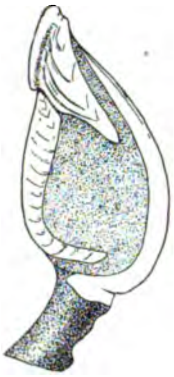

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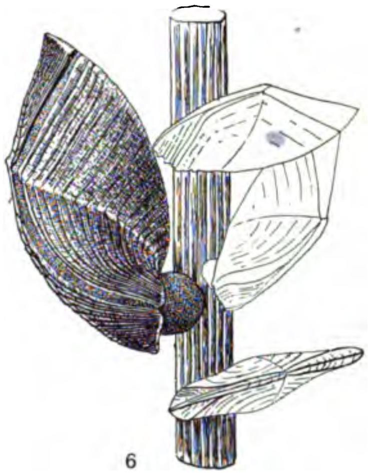

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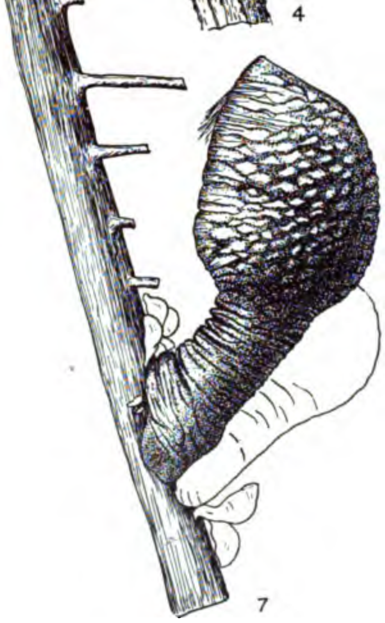

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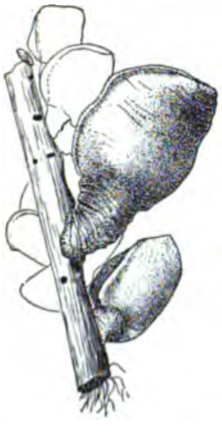

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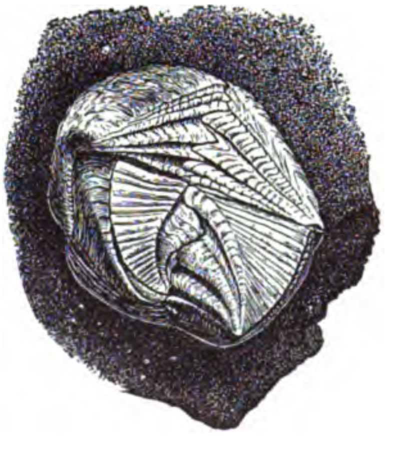

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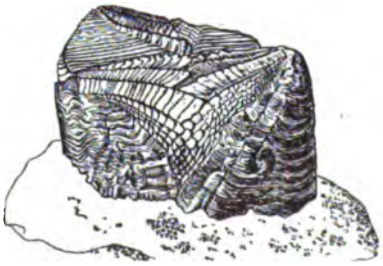

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1–2. *Scalpellum hawaiense.* Type, side and carinal views.
3. *Scalpellum pacificum.* Detail of structure at base of carina.
4. *Scalpellum pacificum.* Type.
5. *Dichelaspis hawaiensis.* Type.
6. *Poecilasma bellum.* Type.
7. *Alepas rex.* Type.
8. *Alepas percarinata.* Cotypes.
9–10. *Verruca halotheca.* Type. Top and carino-rostral views.

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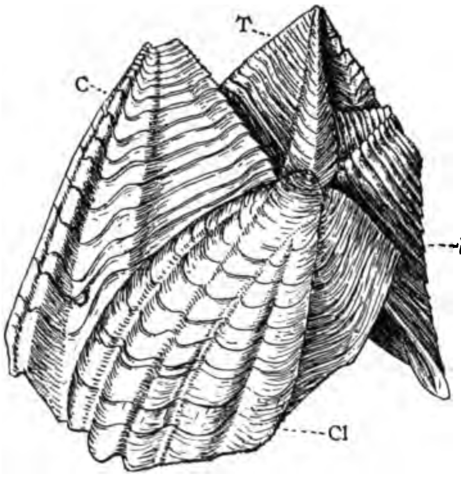
PLATE V.



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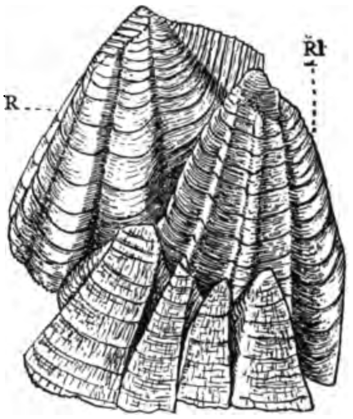

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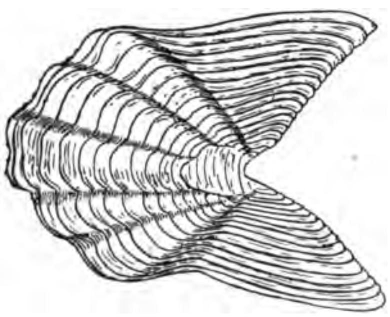

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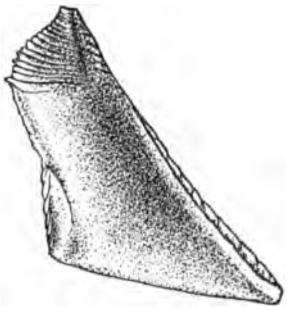

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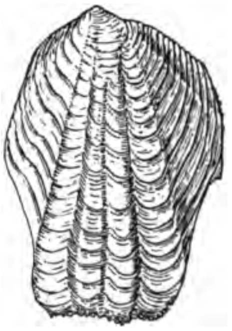

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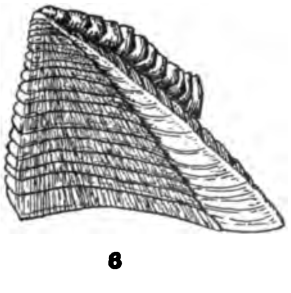

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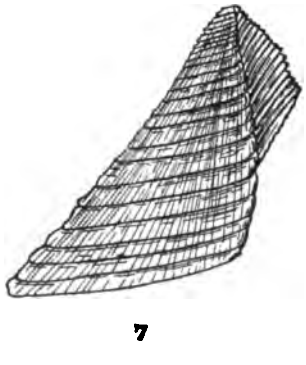

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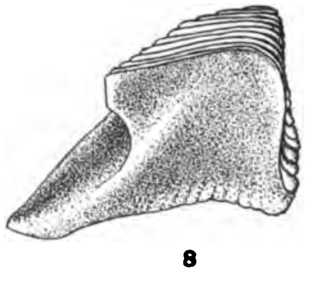

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Catophragmus darwini.

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CIRRIPEDIA FROM THE PACIFIC COAST OF NORTH AMERICA.

By HENRY A. PILSBRY, Sc. D.

Special Curator, Department of Mollusca, Academy of Natural Sciences of Philadelphia.

BUREAU OF FISHERIES DOCUMENT NO. 617.

CIRRIPEDIA FROM THE PACIFIC COAST OF NORTH AMERICA.

BY HENRY A. PILSBRY, SC. D.,
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The cirripedes have been neglected by American zoologists and, consequently, aside from a few references to littoral species in Darwin's Monograph on Cirripedia, almost nothing has been published upon the west-American forms. The littoral species, especially of *Balanidæ*, stand in need of thorough study, while only a beginning is now made in the description of the deeper-water forms, which will doubtless prove numerous.

The following report is based upon collections made by the steamer *Albatross* in Alaska and northwestern Washington in 1903 and off the coast of southern California in 1904.

It has not been thought necessary to give full references to the literature of each species. Such bibliographic matter may be found in the following works:

1851. DARWIN, CHARLES. A Monograph on the subclass Cirripedia. The Lepadidæ or pedunculated cirripedes.

1854. ———, ———. The Balanidæ or sessile cirripedes, etc.

1883. HOEK, P. P. C. Report on the Cirripedia collected by H. M. S. *Challenger* during the years 1873-76 Challenger Report, Zoology, vol. VIII.

1897. WELTNER, W. Verzeichniss der beschreibenen recenten Cirripedenarten. Archiv für Naturgeschichte, jahrg. 1897, bd. I, p. 227.

1905. GRUVEL, A. Monographie des Cirrhipèdes ou Thécostracés. Bibliography on p. 464-467.

LEPADIDÆ.

Lepas anatifera Linnæus.

Station 4391, off Santa Catalina Island, on floating wood.

Lepas pectinata Spengler.

Stations 4337 and 4351, off Point Loma Light, near San Diego, Cal., on surface. Station 4406, southeast point of Santa Catalina Island, surface, on giant kelp. Also station 4372.

Lepas fascicularis Ellis and Solander.

South point of south Coronado Island, station 4340, 46 fathoms. The *Lepas* was probably taken at the surface as the trawl came up, not at the depth given.

Scalpellum phantasma n. sp.

[Pl. vi, fig. 1.]

The capitulum is ovate, composed of 13 plates of which only a slender skeleton is calcified. There is no membranous covering or pilosity. The calcified parts are white, the chitinous interspaces creamy gray. The occludent margin is strongly and evenly arched in a single curve.

The calcified portion of the scutum consists of a band along the occludent margin, widening below, where it is biramose, and a very narrow curved band along the tergal margin of the plate, diverging V-like from the apex. The umbo is apical.

The tergum is V-shaped, consisting of a wider band along the occludent margin and a narrower, longer band near the carinal margin of the plate.

The carina is simply arched, with subapical umbo. The roof is a rather narrow gutter between two high, rounded marginal ribs. The sides are very narrow below, widening above, and spreading in a rounded lobe above the umbo.

The upper lateral plate is calcified in form of an unequally three-armed swastika, the shortest arm is directed upward, the longest obliquely downward and toward the carina, the third arm runs toward the inframedian lateral plate. The arms are slender, curved, and acute at the ends.

There is no rostrum. The rostro-lateral plate is biramose, being calcified along the occludent margin, with a slender arm ascending toward the upper lateral plate and a wider one along the basal margin.

The infralateral plate has a median umbo, a slender ascending arm, a widening descending portion, and a short arm reaching toward the carina.

The carino-lateral plate is L-shaped, with the longer branch ascending near the carina and the shorter along the basal margin. The umbo projects below the base of the carina.

The peduncle is cylindrical, protected by wide, short scales, not in the least imbricating, 9 or 10 in any of the 8 longitudinal rows.

Length of the capitulum 28 mm., breadth 15 mm., diameter 7 mm. Length of the carina 23 mm. Length of the peduncle 8. 5 mm, diameter in the middle 5.5 mm.

Type, no. 32421 U. S. National Museum, from *Albatross* station 4397, off Santa Catalina Islands, 33° 10′ 15″ N., 121° 42′ 15″ W., 2,196 fathoms, gray mud. A single specimen.

This peculiar species is perhaps the finest of the "incompletely calcified" forms. It is related by the shape of the carina to *S. gruvelianum*. Among the imperfectly calcified forms it is most related to *S. marginatum* Hoek, from north of New Guinea, but differs from that in the shape of the upper lateral plate, the regular arch of the occludent margin, and other characters. It was taken at a greater depth than other Californian cirripedes.

Scalpellum larvale, n. sp.

[Pl. vi, fig. 2–6.]

Capitulum oblong, the occludent and carinal outlines about equally convex, composed of 13 valves which are but partially calcified. Rostrum wanting. Surface not hairy. Umbo of the carina apical.

The calcified part of the scutum is shaped like an inverted letter Y, the umbo being apical, minute and acute, and extending noticeably over the tergum.

The calcified portion of the tergum is in the form of an inverted V, with the addition of a small ledge on the carinal side of the apex. The carinal limb of the V is much longer than the occludent.

The carina is much better calcified than the other plates. It is very long, extending about three-fourths the length of the tergum, simply arched, the curvature being greater above. The roof is flat, passing rectangularly into the narrow sides.

The upper lateral plate is narrow, somewhat boomerang-shaped. The rostro-lateral plate is narrow, transverse, with parallel upper and basal margins. The inframedian lateral plate is arrowhead-shaped, acute above, biramose below, small. The carino-lateral plate is calcified in form of an inverted T and is much smaller than the upper lateral plate.

The peduncle is very short, rather sparsely protected by very wide, short scales. It widens slowly from the base to the capitulum.

Length of the capitulum 13.3 mm., width 7 mm., diameter 3 mm. Length of the carina 11 mm. Length of the peduncle 5 mm., diameter in the middle 2.3 mm.

The mandibles (fig. 1, A) have 4 strong acute teeth and a lower point at the inferior angle.

The maxillæ (fig. 1, C) have a straight anterior margin with irregular strong spines.

The anterior cirri are very short, less than half as long as the second pair; the rami have 6 and 9 joints, respectively. The rest of the cirri are long, composed of long joints, which bear four pairs of spines on the anterior and three pairs of smaller ones on the posterior sides (fig. 1, B, sixth joint of the exopodite of the third cirrus), though the development of spines varies on different parts of the same cirrus.

The caudal appendage (fig. 1, D) is very small, perhaps an eighth as long as the last ramus, composed of four joints, the first one long (perhaps really composed of two joints), the last bearing a terminal tuft of long spines.

Type, no. 32417 U. S. National Museum, from *Albatross* station 4353, off Point Loma Light-House, 639 fathoms, seated on a glassy spine or spicule.

The shape of the scutal and of the inframedian plate is not like any of the known species, *S. insigne* being apparently the nearest.

A young individual in the same group, shown in the figure, is interesting as showing that the young are more normally calcified than the adult stage, the calcification after an early age proceeding only along certain lines indicating the longer axes of the valves. This young individual has a capitulum 5.7 mm. long. The valves of this specimen resemble those of *S. insigne* Hoek more than do those of the adult stage.

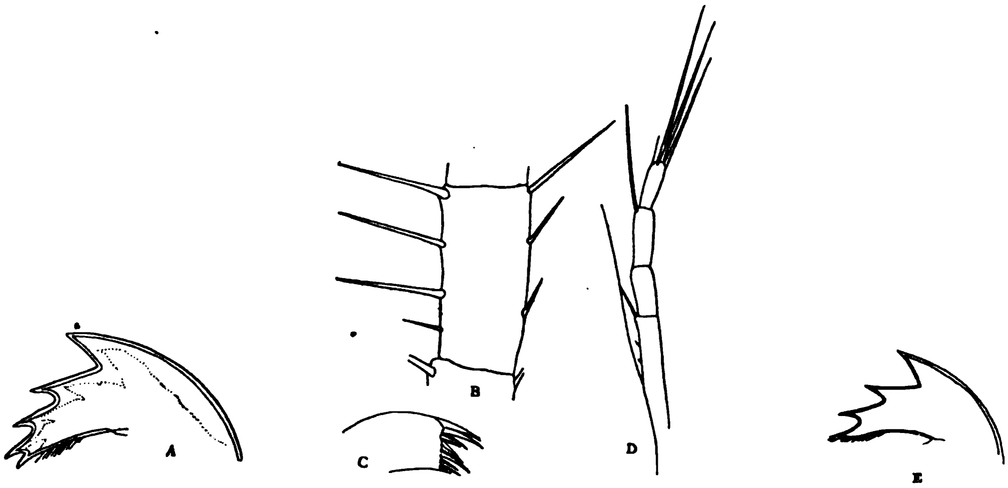


FIG. 1.—*Scalpellum larvale.* A, Mandible; B, 6th joint of the exopodite of the 3rd cirrus; C, maxilla; D, caudal appendage; E, mandible of specimen from station 4382.

A series from *Albatross* station 4382, south point of Coronado Island, in 656 fathoms (type no. 32418 U. S. National Museum), consists of smaller individuals, the largest three measuring about 10 mm. in length of capitulum. The scutal calcification is broader and less deeply bifurcate below than in the type specimen. A series from this lot showing the stages of growth is figured in plate VI (fig. 3–6), all of them being drawn to the same scale.

The anterior cirri have 6 and 10 joints. The other cirri are like those in the type of *S. larvale*. The caudal appendage has 5 joints, but otherwise is as figured for *S. larvale*. The mandibles (fig. 4, E) have three teeth and a spine at the lower end.

Several complemental males were seated in the fold of the sack just inside the occludent borders of the scuta. They are of the degenerate *Cypris*-like form, without plates. Their hosts lack penes. The species therefore belongs to Hoek's third group (Challenger Report, vol. X, Cirripedia, p. 21.)

Scalpellum californicum n. sp.

[Pl. VI, fig. 8, 13.]

The capitulum is composed of 14 normally calcified smooth valves, covered with a membrane which is shortly and delicately pilose. The occludent margin is nearly straight, the opposite margin very convex. The carina is simply arched, with convex rounded roof. The chitinous interspaces are rather wide, and the valve margins usually not very distinct. The color is dirty gray, with most of the valves more or less purplish or livid. The scutum has subparallel occludent and lateral margins and very oblique tergal margin. The basal margin runs at a right angle from the occludent.

The tergum is very long and narrow, its occludent and carinal margins slightly convex, the lower margin sinuous.

The carina is simply arched with apical umbo and convex roof. The upper half of the valve has the roof defined by small lateral ridges, but these become weaker and finally obsolete below, where the valve is wider and the convex roof passes into the sides without distinct boundary. The sides are narrow throughout and excavated in a shallow furrow along the lateral ridges. The carina extends upward to the middle of the carinal margin of the tergum.

The upper lateral plate is trapezoidal, the carinal, tergal, and scutal margins slightly convex, the basal margin straight and abutting on the inframedian lateral plate only. The angles are somewhat rounded off, and the umbo is at the tergo-scutal angle.

The rostrum is small, subtriangular, with apical umbo. The rostro-lateral plate is small and wedge-shaped, being narrower in front.

The inframedian lateral plate is well developed, nearly square, as wide as high, its forward (or ventral) margin convex, and bounded more by the scutum than by the rostro-lateral plate. The other margins are straight. The umbo is central.

The carino-lateral plate is small, irregularly reniform or lunate with blunt ends, with concave carinal margin and convex latero-basal margin. The umbones scarcely project at the base of the carina.

The peduncle is long, approaching the capitulum in length, its lower half cylindric, upper half gradually widening to the width of the base of the capitulum. It is very closely and regularly clothed with rather small lozenge-shaped scales, of which there are 20 or more in a longitudinal row.

Length of capitulum 15 mm., width 7 mm., diameter 4 mm. Length of carina 11 mm. Length of peduncle 11.5 mm., diameter in the middle 3 mm.

The rami of the first pair of cirri are very short, with globose segments, 11 and 12 in number. The other cirri are long, composed of long segments, which bear from 5 on the second cirri to 6 pairs of spines on the fifth and sixth cirri.

Albatross stations 4558, 4555, 4551, 4452, 4535, 4439, off Point Pinos Light-House in 40 to 86 fathoms, on mud and rock bottom; the types, no. 32411 U. S. National Museum, from station 4558. Topotypes no. 32412. Seated on annelid tubes, etc. Apparently abundant in the region of Monterey Bay.

S. californicum is an abundant form in comparatively shallow water. It is related to *S. grœnlandicum* and *S. angustum*, of the extreme northern Atlantic, but in these the general shape of the capitulum differs, and most of the plates show more or less diversity. The rostro-lateral plate is much higher in both of the Atlantic forms.

Most of the specimens are smaller than the type, the capitulum 10 to 12 mm. long, with the peduncle less closely scaly. The livid or dried-blood color of the valves or parts of them is variable, some individuals being white. The peduncle varies a great deal in length. It is sometimes only half the length of the capitulum, and yet not more closely scaly than in other individuals with long peduncles.

The figures are from washed specimens with the enveloping membrane partly removed in order to show the valves clearly. Their outlines are much less distinct in uncleaned individuals.

Scalpellum californicum osseum n. subsp.

[Pl. VI, fig. 7.]

Similar in general characters to *S. californicum*, but the valves are more completely calcified, white, with distinct outlines and clear-cut angles, though covered with a thin, transparent, densely pilose membrane. Upper lateral plate distinctly pentagonal, the scutal and tergal margins longest. Tergum shorter and wider than in *californicum*. Peduncle long, very sparsely scaly, the scales white; pilose. Length of capitulum, 6.5 mm.

Type, no. 32413 U. S. National Museum, from *Albatross* station 4454, off Point Pinos Light-House, 71 fathoms. Taken also at station 4478, Santa Cruz Light-House, 30 fathoms.

The large number of individuals of *S. californicum*, at all stages of growth, which I have examined show that the above-described form is not a young stage of that species, although it is similar in the number and proportions of the valves.

Scalpellum proximum, n. sp.

[Pl. VI, fig. 9–11.]

Capitulum ovate, compressed, composed of 13 well-calcified valves. There is a well-marked band of integument between the carina and the other valves. It is covered with a thin membrane which is rather closely, shortly pilose. The plates have a sculpture of wide-spaced low ridges parallel to growth lines. The occludent margin forms an even curve nearly as arcuate as the carina.

The scutum is irregularly quadrangular, with convex occludent margin, slightly recurved and very acute umbo, which projects slightly over the tergum; basal margin convex, upper margin concave, and lateral margin sigmoid. The upper latero-tergal angle projects in a point between the apex of the upper latus and the tergum.

The tergum is triangular with recurved apex; occludent margin convex, basal margin straight and oblique, the carinal margin undulating. The carina is very long, regularly arched, with slightly convex, nearly flat roof, bounded by low, rounded lateral ribs. The sides are narrow below, widening above, and at an angle greater than 90° with the roof. It extends upward fully three-fourths the length of the tergum, nearly to its apex.

The upper lateral plate is irregularly pentagonal, the tergal and scutal margins longest, concave, the apex obtuse, being a little built out on the tergal side of the umbo, which is subterminal. The carinal margin is quite short; the basal, which abuts against the inframedian latus, still shorter. There is no rostrum.

The rostral lateral plate is small, quadrangular, nearly as high as wide, with the umbo at the upper angle of its occludent margin. The inframedian lateral plate is narrow, hourglass-shaped, with the umbo at the lower fifth, where the plate is narrowest. Below this is a small triangle and above is a larger one, the upper margin abutting in part on the upper lateral plate, in part on the scutum, with an angle at the suture between these plates. The carinal lateral plate is quadrangular, very much higher than wide, the umbo slightly recurved and projecting below the carina. Its carinal margin is longer than the upper lateral plate, about parallel with its lateral margin; basal margin horizontal, upper margin very oblique.

The peduncle is hardly half as long as the capitulum, covered with wide short scales, of which there are about 9 in any longitudinal row, and about 8 rows.

Length of capitulum 15 mm., breadth 8 mm., diameter 3.4 mm. Length of carina, 13 mm. Length of peduncle 6.5 mm., diameter 3 mm.

Type, no. 32422 U. S. National Museum, from station 4387, 32° 29′ 30″ N., 118° 05′ 00″ W., vicinity of San Diego, Cal., 1,000 fathoms, on an annelid tube.

Somewhat related to *S. gruvelianum*, but quite distinct by the long carina with less strong ribs at its angles, the different shape of the scutum, and of all the lower whorl of plates. It stands very near *S. novæzelandiæ* Hoek, which has a capitulum of the same general shape, the valves similarly separated by narrow chitinous interspaces. In *S. proximum* the occludent margin is more convex; the roof of the carina is apparently greater in width below; the upper lateral plate is obtuse at the apex, not acute as in Hoek's species; the inframedian lateral plate differs in shape; and finally the portions of the carinal lateral projecting below the carina are shorter. *S. flavum* Hoek is also very closely related, but differs by the shape of the inframedian and carinal lateral plates.

S. proximum belongs to a very widely distributed type of the genus, ranging probably through all seas. Gruvel has identified *S. novæzelandiæ* from the north Atlantic, taken by the *Travailleur* in 2,400 to 2,500 meters; and it may eventually be found expedient to subordinate a number of the allied forms to *novæzelandiæ* as subspecies.

Scalpellum gruvelianum, n. sp.

[Pl. VII, fig. 1–3.]

Capitulum compressed, composed of 13 well-calcified valves, covered with a thin membrane which is sparsely hirsute, especially on and near the carina. The plates have no sculpture other than low, wide-spaced growth wrinkles.

Scutum quadrangular, with convex occludent margin, concave tergal, straight lateral and basal margins; the umbo is noticeably recurved and projects slightly over the tergum.

Tergum triangular, the occludent margin convex, apex recurved, scutal margin straight, carinal margin straight, except near the apex, where it is concave. The carina is evenly arched with apical umbo, the roof flat, bounded by a strong rounded ridge along each side; the sides at a little more than 90 degrees with the roof, widest above. It extends beyond the middle of the tergum. The upper lateral plate is quadrangular, the sides straight, scutal margin much the longest, fully twice as long as the carinal margin; umbo apical.

There is no rostrum. The rostral lateral plate is quadrangular, a little narrower in front, being thus somewhat wedge-shaped. It is much shorter than wide. At the occludent margin the umbones are contiguous and project a little. The inframedian lateral plate is very small and narrow, wedge-shaped, with apical umbo. The carinal lateral plate is very irregular in shape, much higher than wide, the umbones projecting and recurved beyond the base of the carina. The carinal margin is equal in length to the scutal margin of the upper lateral plate.

The peduncle is about half as long as the capitulum, pretty closely covered with wide, short scales, and sparsely hairy.

Length of capitulum 17 mm., breadth 9 mm., diameter 3 mm. Length of carina 13 mm. Length of peduncle 9 mm., diameter 3 mm.

Type, no. 32414 U. S. National Museum, from station 4418, Southwest Rock, Santa Barbara Island, 238 fathoms, on an annelid tube, gray sand bottom. The half dozen specimens of the type lot show no mentionable variation. Only two reached the dimensions given above, the others being two-thirds to three-fourths that size.

Scalpellum tritonis Hoek and *S. luteum* Gruvel, both Atlantic species, rather closely resemble this form in lateral aspect. *S. tritonis* has a flat-roofed carina. In *S. luteum* the carina is bicostate, but the inframedian lateral plate is wider at the base, triangular, the shape of the carinal lateral plates below the carina is different, etc. It is from near the Azores, and seems, in the ensemble of its characters, to be more nearly related to *S. gruvelianum* than any other species now known. *S. planum* Hoek has a carina with similar raised angles, but the other plates differ widely. By the keys of Hoek and Gruvel, *S. gruvelianum* comes out to *S. planum*, but a place can easily be made for it by attention to the shape of scutum and the lateral plates.

This species is respectfully dedicated to M. A. Gruvel, author of various valuable works on cirripedes, including a useful monograph.

Scalpellum gruvelianum secundum, n. subsp.

[Pl. vii, fig. 4.]

Similar to *S. gruvelianum* in general characters, but the carina extends somewhat higher on the tergum, the sutures are wider, the plates being more separated by chitinous interspaces, and the infralateral plate differs in shape, being somewhat wider above than below, with subcentral umbo, the lower half of the plate being raised in a short thick ridge. Length of capitulum 9 mm., of peduncle 4 mm.

Type, no. 32415 U. S. National Museum, from *Albatross* station 4429, Gull Inlet, south coast of Santa Cruz Island, in 506 fathoms, gray mud.

Represented by a single specimen, which while obviously related to *S. gruvelianum*, yet presents a number of differences which seem to indicate another variety or species. The apices of the terga seem to have been broken or worn off.

Scalpellum perlongum, n. sp.

[Pl. vi, fig. 12.]

The long and narrow capitulum is composed of 13 white valves, is nearly nude and nowhere hairy. There is no rostrum; the umbo of the carina is apical; the valves are wholly calcified, and marked with growth lines.

The scutum is quadrangular, convex, with the occludent margin convex above, straight below. The umbo slightly overlaps the tergum, tergal margin oblique, basal margin slightly convex. The lower anterior part of the valve is sculptured with weak radial striæ.

The tergum is longer than the scutum, triangular, the occludent margin convex, basal margin straight, carinal margin sinuous.

The carina is very long, extending to the upper third of the tergum, and is arcuate, much more strongly so above than below. The roof is slightly convex, nearly flat, the sides meeting it at right angles, but without ribs at the angles. The sides are widest near the apex.

The upper lateral plate is quadrangular, the scutal margin longest and concave, the tergal, carinal, and basal margins shorter, subequal, nearly straight. The lower anterior angle is cut off, abutting against the inframedian lateral plate. The rostro-lateral is squarish, as high as wide, the upper and side margins subequal, the basal margin decidedly shorter. The umbo is at the upper occludent angle.

The inframedian lateral plate is very long and narrow, somewhat wineglass-shaped, being narrowest below the middle, widening slowly above and rapidly at the base. The umbo is at the narrow part.

The carino-lateral plate is very long—fully twice as long as wide. The lateral and carinal margins are subparallel, the upper margin very oblique and near the base curving out below the carina, beyond which the umbones bluntly project.

The peduncle is short and slender, rather sparsely protected by large scales, of which there are about six in any longitudinal row.

Length of capitulum 8.8 mm., breadth 3.3 mm., diameter 1.2 mm. Length of carina 6.6 mm. Length of peduncle 2 mm.

Type, no. 32420, U. S. National Museum, from *Albatross* station 4353, off Point Loma Light-House, vicinity of San Diego, in 639 fathoms, on a glassy spine or spicule; gray mud bottom.

Chiefly notable for the long plates of the basal whorl and the elongation of the whole capitulum. It is very closely related to *S. flavum* Hoek, from the South Atlantic, lat. 46° 46′ S., lon. 45° 31′ E., in 1,375 fathoms, but differs by the quadrate rather than triangular rostro-lateral plate, its basal margin being much longer than in *S. flavum*, by the narrower sides of the carina, and the narrower carino-lateral plate. Three specimens were on the same glassy spicule which bore the types of *S. larvale*.

BALANIDÆ.

Balanus concavus Bronn.

Balanus concavus Darwin, Balanidæ, p. 235. G. C. Martin, Maryland Geological Survey, Miocene, p. 94, plates 33, 34, 1904.

Stations 4303 and 4304, Point Loma Light-House, vicinity of San Diego, in 21 to 25 fathoms; 4420, East Point San Nicolas Island, 33 fathoms; 4492, Santa Cruz Light-House, 26 fathoms.

The specimens belong to the small, conic, pink-striped form already known from Panama. This race is very unlike the large form of the Virginia and Maryland Miocene and the more rugged, irregular specimens of the Caloosahatchee Pliocene, but Darwin considers that such varying races are all referable to *B. concavus*.

Balanus aquila, n. sp.

[Pl. VIII, fig. 5–8; pl. X, fig. 2; pl. XI, fig. 2.]

A large species related to *B. psittacus* (Molina). Basis, parietes, and radii permeated by pores, but they are minute and inconspicuous except in the parietes.

The wall is conical with small orifice, roughened by irregular rude ridges on the parietes, whitish where not covered with a bright yellow cuticle, which remains chiefly near the base. It is thick, strong, and dense, porous only in the outer layer. The radii are rather narrow, the alæ concealed. The sheath is long, sculptured with minute thread-like transverse raised lines. Below it the interior is white with some yellow stains, and closely, irregularly striated. The white basis is level, thin, and solid except for a very few pores which in some places penetrate its lower or attached portion. The sutures are inconspicuous and smooth within, but the separated plates show transversely striate edges.

The scuta (pl. VIII, fig. 7, 8) are dull yellow inside, whitish beneath, a brownish-yellow cuticle externally. The plate is curved inward on both tergal and occludent borders, but more so on the former. The basal margin arches upward and is quite arcuate, bringing the baso-tergal angle above the middle of the valve's length. The surface is sculptured with close, fine, deeply cut longitudinal grooves, decussated by shallower, wider transverse or concentric furrows, cutting the striæ into beads or granules. Inside, the scutum has a sharp, raised and reflexed articular ridge, and a deep, narrow articular furrow. There is a strong adductor ridge, not confluent with the articular ridge. Inside the beveled margin of the lower half of the occludent border there is an inflected sharp ridge. Toward the basal margin the inner surface is longitudinally grooved.

The tergum (pl. VIII, fig. 5, 6) has a long purple beak, one-fourth the length of the whole plate. The outer surface is worn above, but the lower part is cancellated like the scutum. The longitudinal sulcus is closed by infolding of its sides. The spur is long, rounded at the end, and situated at less than its own width from the scutal margin. On both sides the basal margins slope steeply to the spur. The interior is yellow, with a long purple spot in the middle. Articular ridge short, suberect and thin. A low, flat, gently arcuate rib runs from the spur to the apical beak, in which a fine cavity penetrates from the apex of the purple spot. The depressor crests are few and not very strong.

Basal length of the walls 70 mm., height 75 mm. Length of the scutum 31 mm., breadth 13.5 mm. Length of tergum with spur 32 mm., breadth 12 mm.

The mandible (fig. 2, B, left side) has four small teeth, the last adjacent to several low obtuse denticles at the lower end. The end of the maxilla is sigmoid, the upper half excavated, the lower convex. It is armed with numerous stout and slender spines (fig. 2, C, right side). The first pair of cirri has wide rami like moth antennæ, the posterior one three-fourths as long as the anterior, with greatly protruding segments, about 22 in number. The segments of the anterior ramus are less protruding and about 30 in number. The second cirri (fig. 2, A) have subequal branches, and the protrusion of the segments reaches its maximum. The third cirri are longer, with much less protruding segments. The other cirri are much more slender, longer, with about 5 pairs of long spines on each joint.

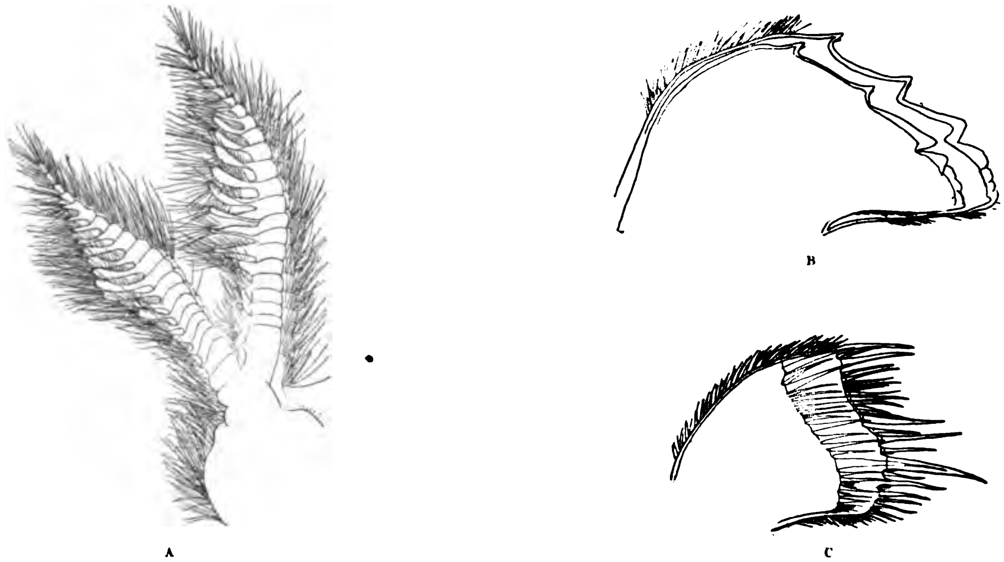


FIG. 2.—*Balanus aquila.* A, Second cirrus; B, mandible; C, maxilla.

Type, no. 32403, U. S. National Museum, from *Albatross* station 4496, off Santa Cruz Light-House, 10 fathoms, fine gray sand and rock bottom.

The dense structure of the walls of this species would almost entitle it to a place in Darwin's section C of the genus *Balanus;* but it is clearly related to *B. psittacus* of the Chilean coast by the structure of the opercular plates and the cirri. It differs from *B. psittacus* in the following respects:

The sculpture of the opercular plates is unlike, the longitudinal grooves being far deeper, and the transverse ridges closer. The occludent margin of the scutum is bent inward, as well as the tergal margin. The adductor ridge in the scutum stands free from the articular ridge throughout, whereas in *B. psittacus* the confluence of the two ridges forms a deep vaulted cavity above the depressor muscle impression. The terga are much alike, but in *B. aquila* there is no ridge along the carinal side of the purple streak, such as occurs in *B. psittacus,* and externally the longitudinal sculpture is coarser and the transverse much closer. There are numerous other differences in the walls, etc., but those given above are amply sufficient for the discrimination of the species.

Balanus, sp. undet.

Two very large barnacles were taken at *Albatross* station 4209, Admiralty Inlet near Port Townsend, Wash., on rocky, coarse sand and shell bottom in 25 fathoms. I have been unable to identify them with any described form, but since they are much worn externally and riddled by boring sponges, study of them is deferred until better preserved material comes to hand. The cup is remarkable for the deeply concave pocket-like base and the smooth interior walls of the parietes.

Balanus glandula Darwin.

Balanus glandula Darwin, Monog. Balanidæ, p. 265.

Quarantine station, Port Townsend, Wash., on *Purpura crispata*. *Albatross* station 4219, Admiralty Inlet in the same vicinity in about 16 fathoms, on broken gastropod shells. Other Alaskan localities are Sitka and Unalaska, collector Dr. Benjamin Sharp, in collections of Academy of Natural Sciences of Philadelphia. Specimens were also taken at Nanaimo Bay, on shore, by Prof. H. Heath. This is a common Alaskan barnacle.

Balanus sp.

Albatross station 4457, off Point Pinos Light-House, 46 fathoms, on a gorgonian. Immature.

Balanus sp.

Albatross station 4561, Santa Cruz Light-House, 15 fathoms. Immature specimens on waterlogged twigs, caught in the tangles.

Balanus flos, n. sp.

[Pl. IX, fig. 1–7.]

A species of Darwin's section C, somewhat related to *B. spongicola* Brown. Base and parietes porous, radii solid.

The wall is high, steep, and tubular, with somewhat square base and aperture, pink outside and within. The parietes usually have a few rather strong ribs, but may be nearly smooth. The radii are smooth, with strongly serrate edges, and slope very steeply from the apices. The alæ are smooth, very narrow, with smooth edges. The apices of the plates project as strong teeth around the aperture and are more or less recurved, giving it a corolla-like appearance, the aperture being nearly as large as the base. The inner submargins of the alæ are sculptured with slender thread-like transverse raised lines especially developed in the carina and carino-lateral plates. Below the sheath the inner surfaces of the parietes are white and are longitudinally grooved, as usual. The base is rather thin, but porous. The opercular plates are white.

The scutum (pl. IX, fig. 3, 6, 7) is triangular, with strongly recurved apex and low sculpture of flattened, unequal wrinkles parallel to the basal margin. There are no noticeable radial lines, though an extremely indistinct and fine striation is discernible under a strong lens. Internally (fig. 6) there is a small, low articular ridge and a small adductor ridge occupying the median third of the valve's length and not confluent with the articular ridge. The muscles are inserted so superficially as to leave no pits, the inner faces of the valves being remarkably flat. The narrow occludent margin is marked with very oblique sulci.

The tergum (pl. IX, fig. 4, 5) is not beaked apically. Very faint longitudinal striæ may be traced along the carinal margin, but elsewhere the plate is sculptured with low, wide-spaced growth marks. There is no furrow running to the spur, but the growth-lines are deeply sinuated where it should be. The spur is short and rather wide. Inside there is a strong, elevated, and acute articular ridge, no noticeable articular furrow, and the ridge running to the spur is very low. Crests for the attachment of depressor muscles are very small. The scutal margin of the tergum is evenly concave.

Length of the wall at base 12 mm., breadth 11.5 mm., height 16 mm. Length of the aperture from apex of the carina to apex of the rostrum, 10 mm.

Length of the wall at base 11.5 mm., breadth 12 mm., height 12 mm.; length of the aperture 8.5 mm.

The mandibles (fig. 3, D) have three rather small but strong teeth and a bluntly irregular denticulate lower projection. The maxillæ (fig. 3, C) have two strong spines above, the margin excavated below them, then becoming convex, the lower angle being broadly rounded. The edge bears about 8 spines, the lower ones stronger, and there is a tuft of fine bristles below the lower extremity.

The first pair of cirri (fig. 3, A) have very unequal rami, the longer or anterior branch of about 23 normal segments, and about twice the length of the shorter ramus, which is composed of 11 segments, all of them strongly protuberant on the forward side. The second pair of cirri has rami of 13 and 12 joints, respectively, also strongly protuberant on both branches. The third cirri have longer and more slender rami of 16 and 15 joints, which protrude moderately in front. The anterior ramus is the longer. The fourth, fifth, and sixth pairs of cirri are much more slender, long, and curled, the rami subequal. There are about 36 joints in the branches of the sixth pair (fig. 3, B). The penis (fig. 3, B) is rather short for a *Balanus*, closely annulated.

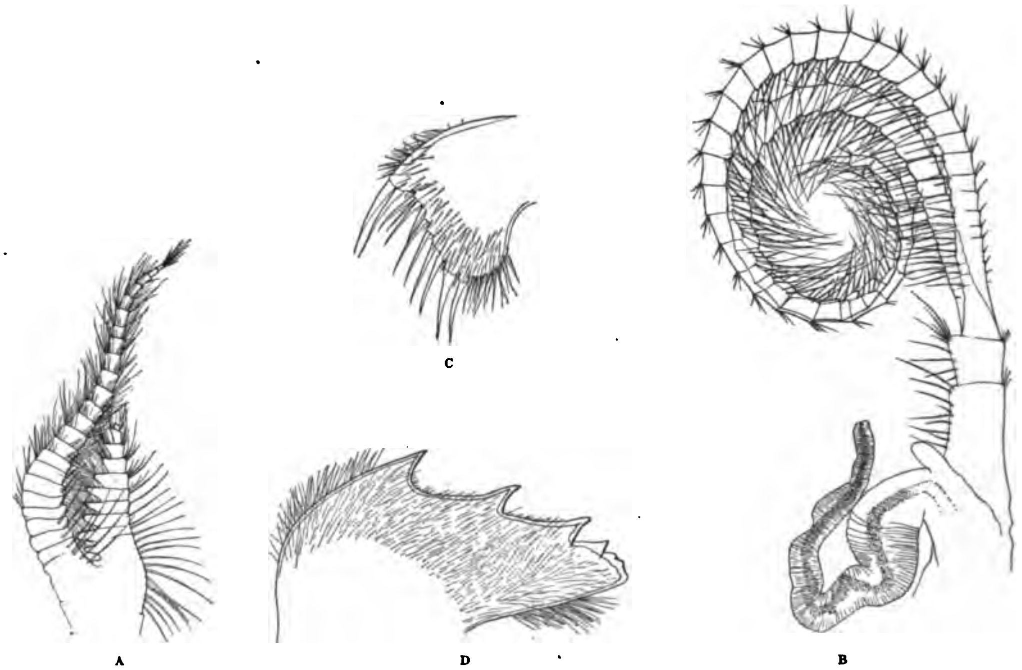


FIG. 3.—*Balanus flos.* A, First cirrus; B, sixth cirrus and penis; C, maxilla; D, mandible.

Type no. 32405, U. S. National Museum, from *Albatross* station 4558, Point Pinos Light-House, 40 fathoms, region of Monterey Bay, on polyzoan colonies. Cotype, no. 32406 U. S. National Museum, from same station. A specimen on a broad seaweed from station 4420, off east point of San Nicolas Island in 338 fathoms, fine gray sand.

This flower-like barnacle superficially resembles *B. amaryllis* Darwin and *B. corolliformis* Hoek, but differs from both in important characters, more especially in the features of the base, which place it in a different section. There seems to be no very closely allied species among those referred to Darwin's section C, except *Balanus spongicola* Brown, of the Atlantic, which differs by the longitudinal sculpture of the scutum, a feature upon which Darwin lays especial stress, and by various other differences in the shape of the scutum and tergum. The mouth parts and cirri would seem to be much as in *B. spongicola*, judging from Darwin's description. *Balanus pœcilus* Darwin differs from *B. flos* by its coloration, the shapes of the opercular valves, and by various features of the cirri.

The diverging apices of the terga are a prominent feature of *B. flos* at all stages of growth. The specimen from station 4420 is very pale pink, almost white, externally.

Balanus evermanni, n. sp.

[Pl. VII, fig. 7–14; pl. VIII, fig. 1–4; pl. X, fig. 1; pl. XI, fig. 1.]

The outer wall is cup shaped, wider above than at the base; the length generally much exceeding the diameter. The compartment plates are not permeated by pores, and the sutures are not calcified or firmly cemented. The heavy calcareous base is likewise imperforate, and the suture where it joins the plates is but very weakly cemented. Surface dull, white, often showing remnants of a thin yellow cuticle. The orifice is very large, not contracted, and squarish or ovate, being narrower and more strongly angular at the carina. All the plates project strongly upward, making the borders of the orifice serrate. The parietes of the two carino-lateral plates are very narrow; those of the other plates are moderately wide; all are weakly sculptured with more or less obliquely transverse wrinkles or ripples, narrow but widely spaced. The radii have finer growth ripples nearly parallel to the tube, and are lanceolate, tapering very slowly upward. The wings or alæ are very wide, with an external upper striated triangle, elsewhere smooth. Internally the plates are closely but not strongly striated near the base. The sutures are smooth and even.

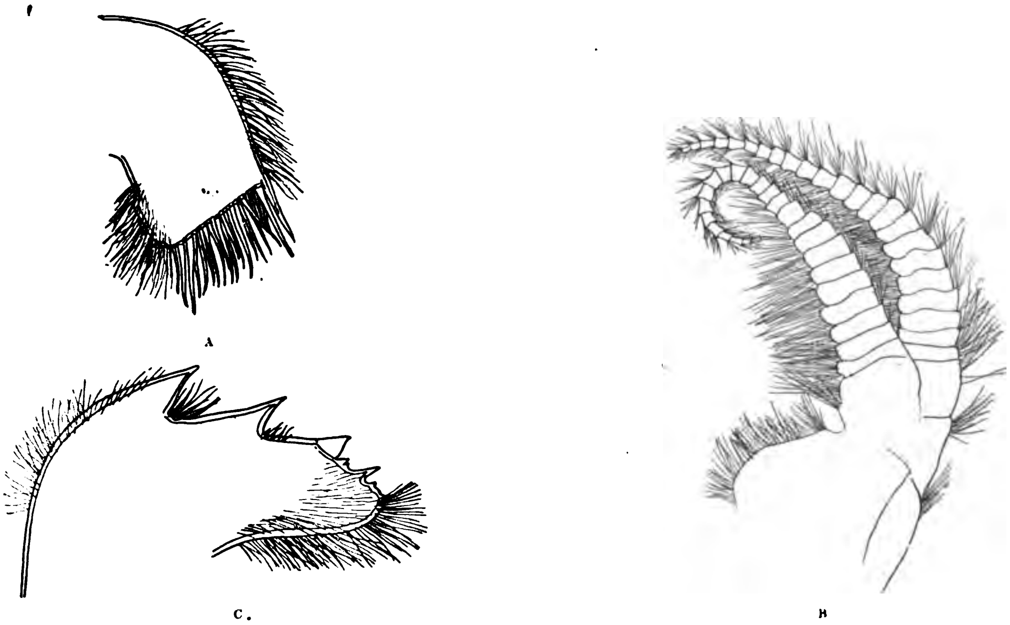


FIG. 4.—*Balanus evermanni.* A, Maxilla; B, second cirrus; C, mandible.

The opercular valves are white under a thin yellow cuticle. The scuta (pl. VIII, fig. 3, 4) have the occludent and tergal margins straight, crenulated at the edge. The adductor muscle impression is shallow and ill-defined, the lateral depressor muscle impression is deep. The adductor ridge is a low, rounded and wide callous rib. The articular ridge is short and not very prominent. The exterior is deeply and subregularly marked with oblique riblets in the direction of growth lines.

The terga are sculptured externally like the scuta, except that the riblets are narrower and more crowded. The longitudinal furrow is open. The apex is not beaked. Scutal margin straight; carinal margin slightly convex. The spur is rather long and narrow. Internally the articular ridge is rather low, blunt, but strong. There are four or five short and delicate ridges at the carino-basal angle. The spur is connected with the articular ridge by a strong, rounded and straight rib (pl. VIII, fig. 1, 2).

Scutum, length 41 mm., greatest breadth 18.7 mm. Tergum, length 33 mm., breadth 13 mm. From a specimen in which the longest valve of the cup is 88 mm. long (station 4239). Length of cup 150; greatest antero-posterior diameter 67 mm., lateral diameter 66 mm. (station 4253).

The penis is extremely long, 30 mm., tapering, flesh colored, and extremely finely and closely annulate.

The mandible (fig. 4, C) has four principal teeth, decreasing in size from the upper to the lower one. The inferior extremity is rounded, and like the lower margin is densely hairy. The maxilla (fig. 4, A) is remarkable for its square, even edge, densely beset with large and small spines.

The first cirrus stands well apart from the others. It has a greatly enlarged basal joint and short, equal rami composed of about 16 joints. The second cirrus (fig. 4, B) is longer, but still is shorter than the following cirri. The joints protrude and are densely bristly on the forward side. The diameters of the rami decrease regularly and slowly from the second to the last pair, but the length is about the same in pairs iii to vi. The third pair of cirri has rami of about 32 joints, and 22 mm. long. The last pair of rami has about four pairs of spines on each joint.

Type, no. 41840 U. S. National Museum, from *Albatross* station 4239, junction of Clarence Strait and Behm Canal, Alaska, in 206 to 248 fathoms, coarse sand and rocky bottom, July 9, 1903. Cotypes, no. 32404 U. S. National Museum, from same station. Taken also at station 4253, Stephens Passage, Alaska, in 131 to 188 fathoms, July 14, 1903.

This is one of the finest species of *Balanus* yet described, remarkable for its great size, the uncemented sutures, and the gaping orifice of the outer shell. The weakness of the ridges and crests of the inner faces of the valves is also notable. Until nearly adult the plates of the wall may be readily separated without breaking them; and even the full-grown barnacle has only a membranous attachment between the valves and the base.

The species is closely related to *B. hameri* (Ascanius) of the North Atlantic, as defined by Darwin, but differs in numerous details. The spur of the tergum is much narrower, only about half as wide as the space between it and the basi-scutal angle. The scutal and carinal margins of the tergum are more nearly straight. The articular ridge is weaker in both scutum and tergum. The maxillæ have no "deep notch under the two upper great spines," having an even edge. The inferior angle of the mandible is not spinose. The segments of the second pair of cirri scarcely protrude in front in either *B. evermanni* or *B. hameri*. The opercular valves show traces of radial (longitudinal) striæ only near the apices. They exceed in size the large fossil valves of *B. hameri* figured by Darwin in the Monograph on the Fossil Balanidæ (pl. 1, fig. 7c, 7d).

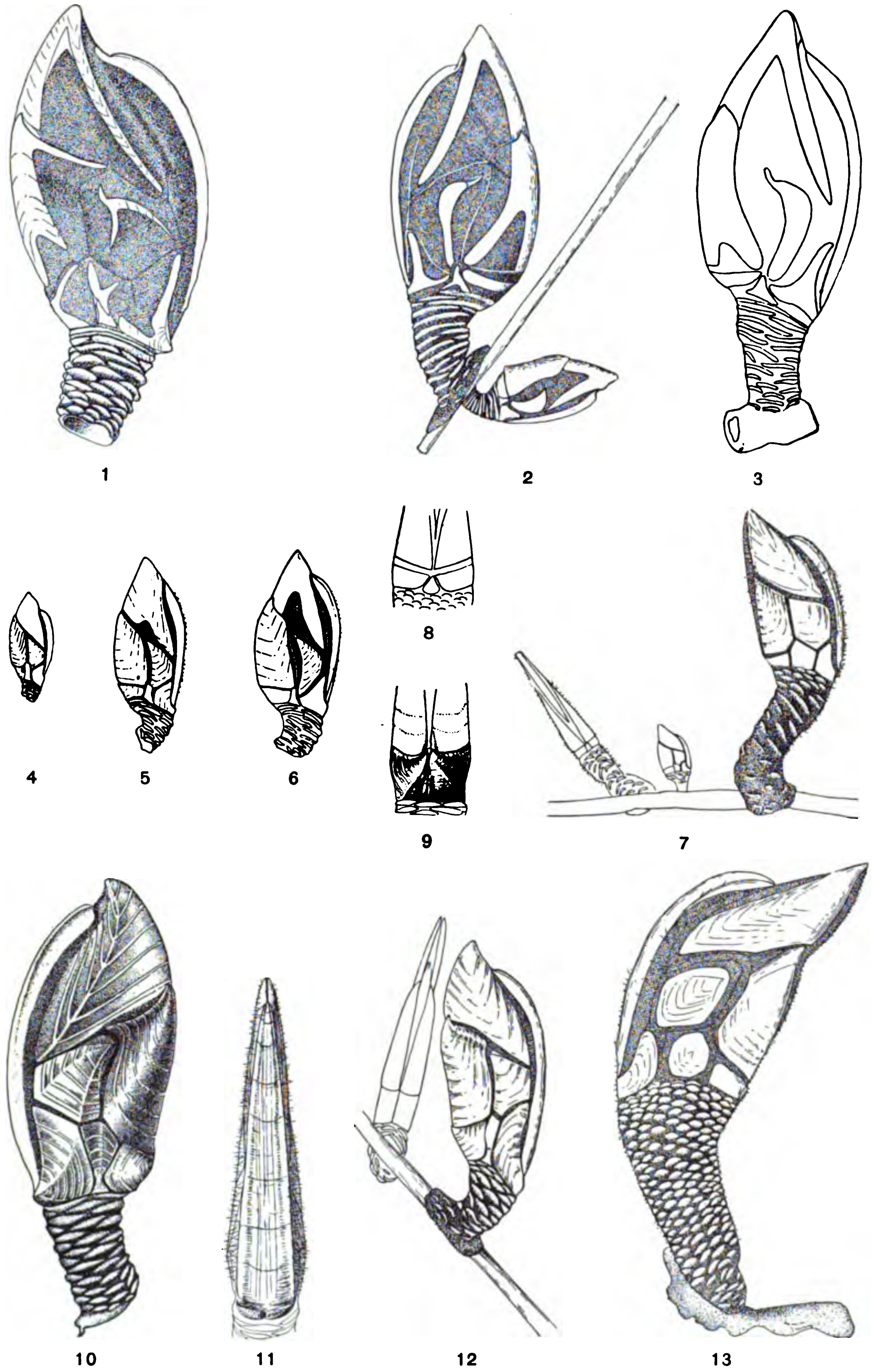
B. evermanni grows in clusters, one mounted upon another. The structural weakness consequent upon the lack of sutural cement is evidently a modification correlated with a deep water habitat. No littoral barnacle of such feeble structure could exist.

Balanus (Conopea) galeatus Linnæus.

[Pl. VII, fig. 5–6, and pl. IX, fig. 8–11.]

Several dead specimens were brought up at *Albatross* station 4432, Brockway Point, Santa Rosa Island, in 272 fathoms gray mud, attached as usual to gorgonians. The cups were empty or filled with sand, but from the débris I obtained two scuta and a tergum. As no species of this section of *Balanus* has been reported from the west coast of America hitherto, and *B. galeatus* has been known heretofore as an exclusively warm-water form of the Antillean region, some details regarding the Pacific specimens may be useful.

The cups are rather short, only one (fig. 5) showing the tendency to lengthen the carina into a point, as is so characteristic of *B. galeatus*. The base is somewhat porous, but less so than the Atlantic specimens of *galeatus* compared. The parietes are solid, and normally grooved inside. The scutum (pl. IX, fig. 10, 11) is triangular, less widely truncate apically than in typical *galeatus* as figured by Darwin. The articular ridge is very thick and prominent. The tergum (pl. IX, fig. 8, 9) resembles that of *B. galeatus* as figured by Darwin, its apex having a squarely truncated appearance, due to the projection of the articular ridge.



1. *Scalpellum phantasma.* Type.
2. *Scalpellum larvale.* Type and a young individual.
3–6. *Scalpellum larvale.* Variety from station 4382, showing changes with growth. Capitula 3, 5, 6, and 10 mm. long.
7. *Scalpellum californicum osseum.* Type and a young specimen.
8. *Scalpellum californicum.* Rostral plate and adjacent parts.
9–11. *Scalpellum proximum.* Dorsal, lateral, and ventral views of type.
12. *Scalpellum perlongum.* Type, and ventral view of a cotype.
13. *Scalpellum californicum.*

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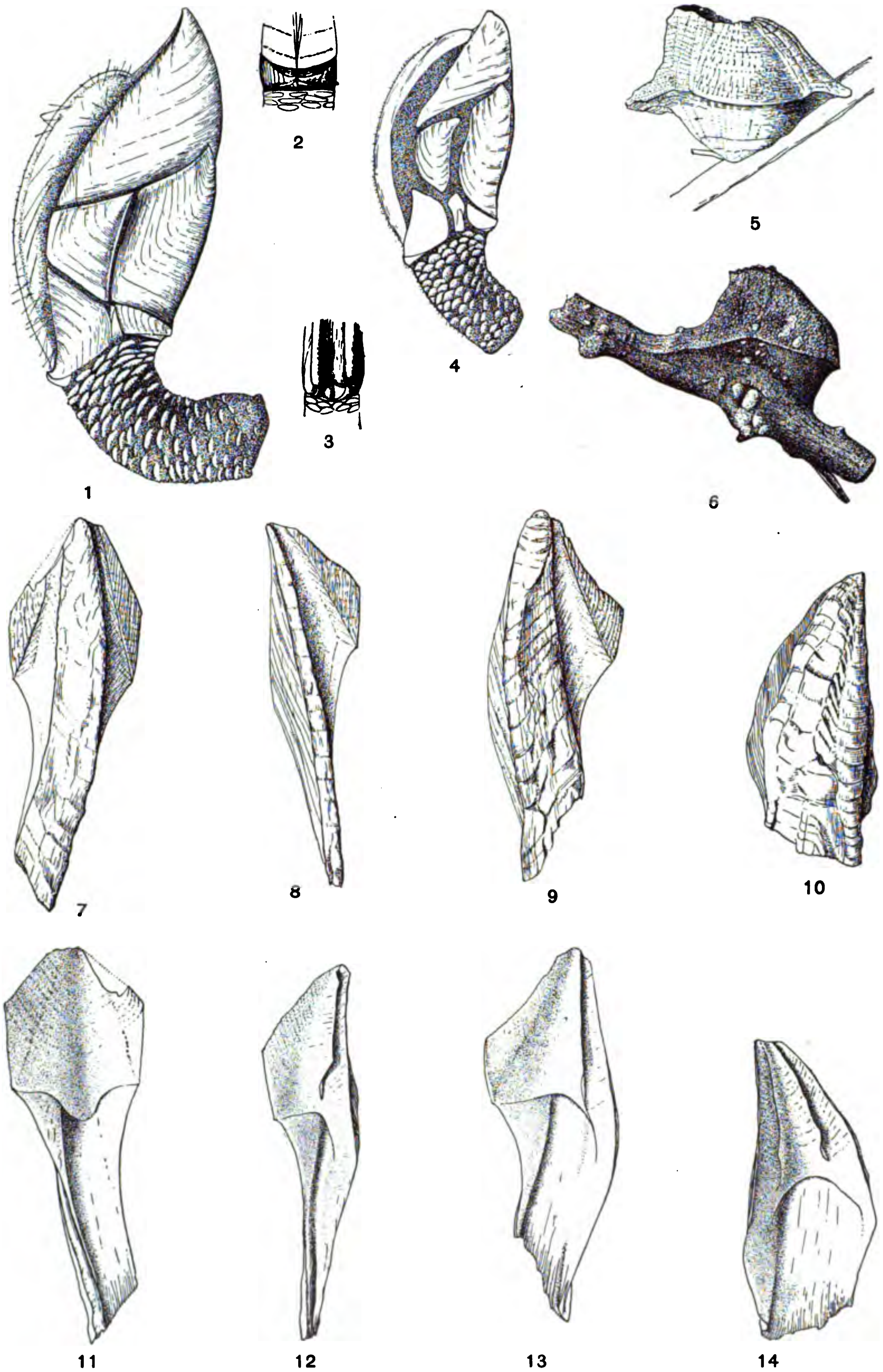

1–3. *Scalpellum gruvelianum.* Lateral view with ventral and dorsal details.
4. *Scalpellum gruvelianum secundum.* Type.
5–6. *Balanus galeatus.* From station 4432.
7–10. *Balanus evermanni.* Carina, right-carinal, and right-rostral latera and rostrum of a cotype. Exterior view.
11–14. *Balanus evermanni.* Interior view. All about ½ natural size.

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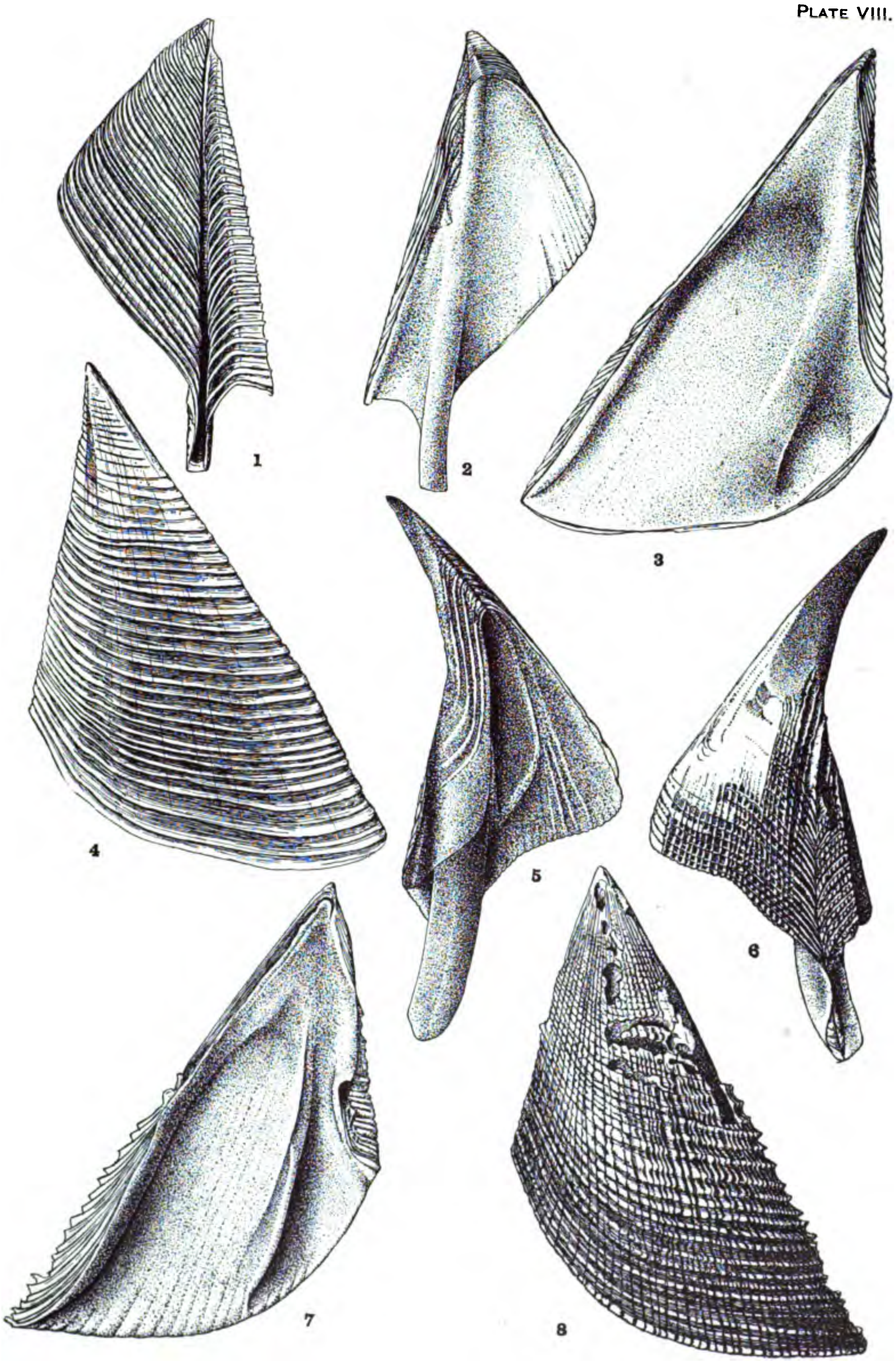
PLATE VIII.



1–4. *Balanus evermanni.*
5–8. *Balanus aquila.*

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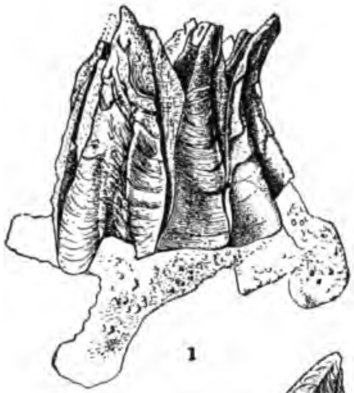
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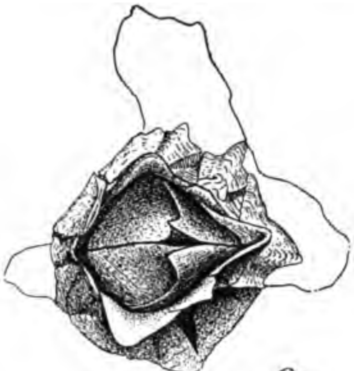
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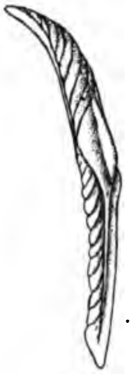
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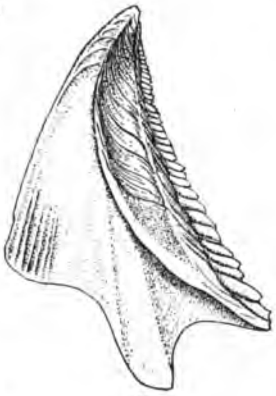
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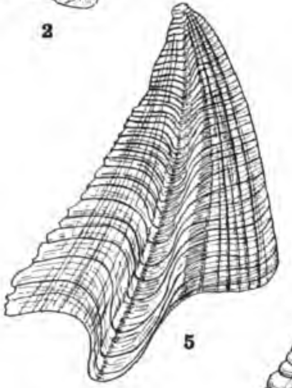
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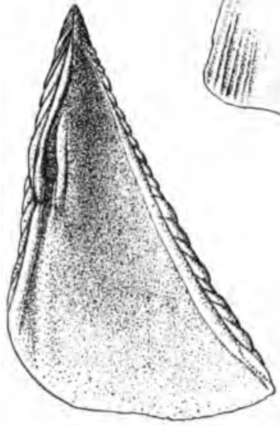
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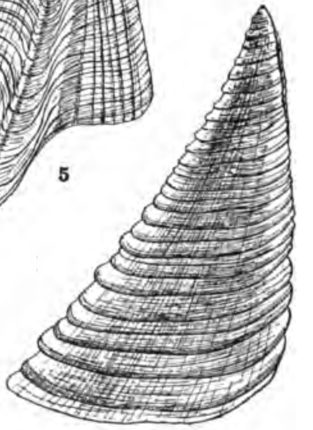
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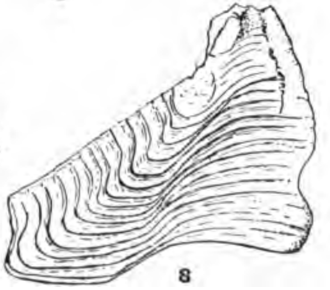
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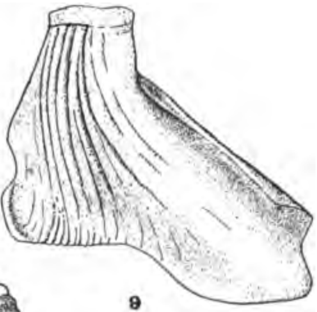
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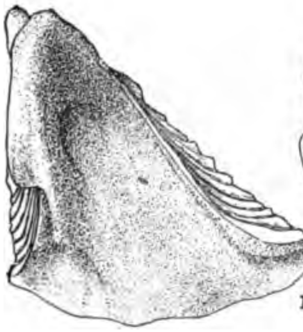
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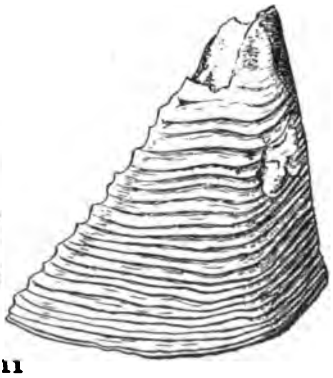
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1–7. *Balanus flos.*
8–11. *Balanus galeatus.*

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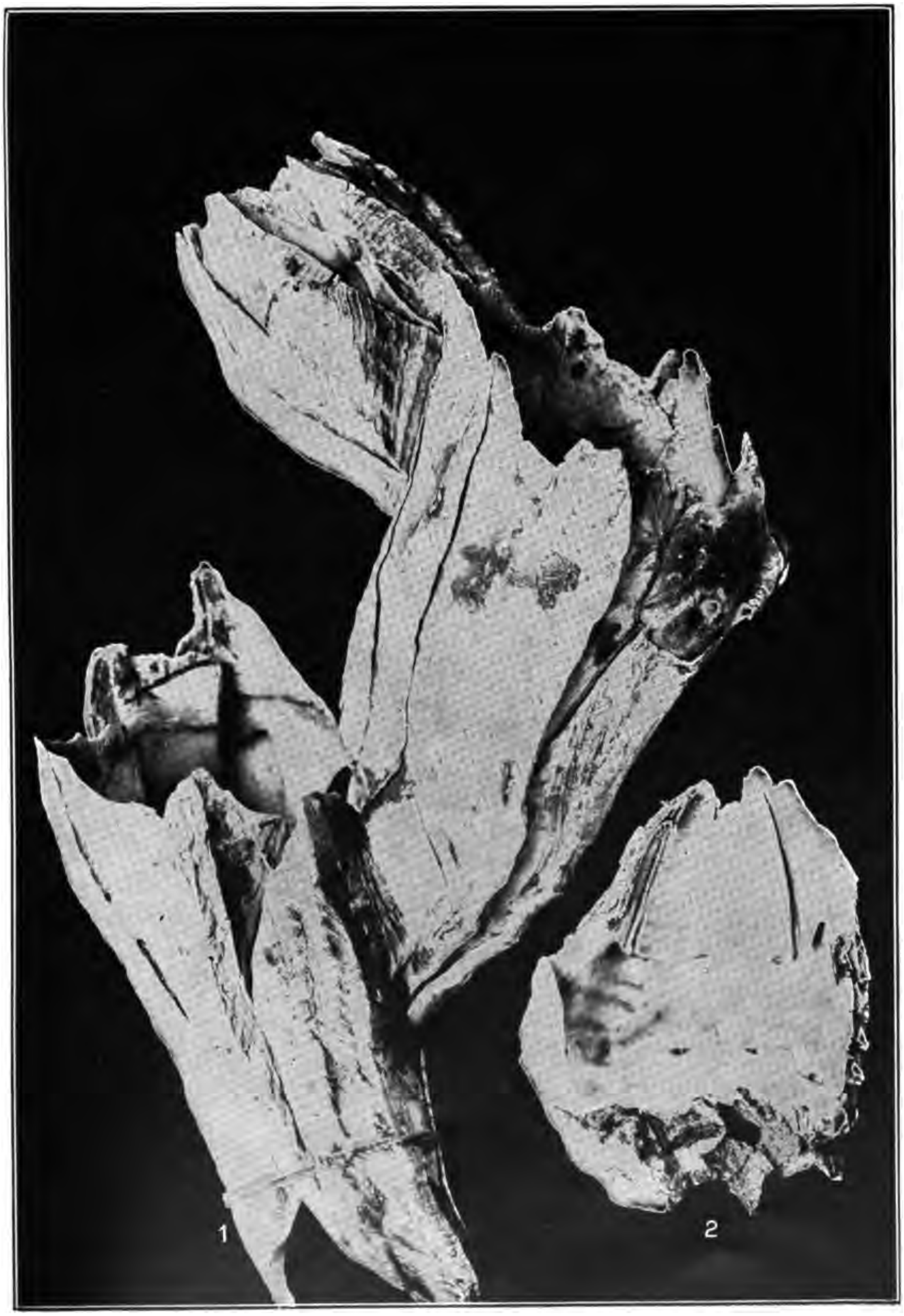

1. *Balanus evermanni.*
2. *Balanus aquila*, interior of wall.

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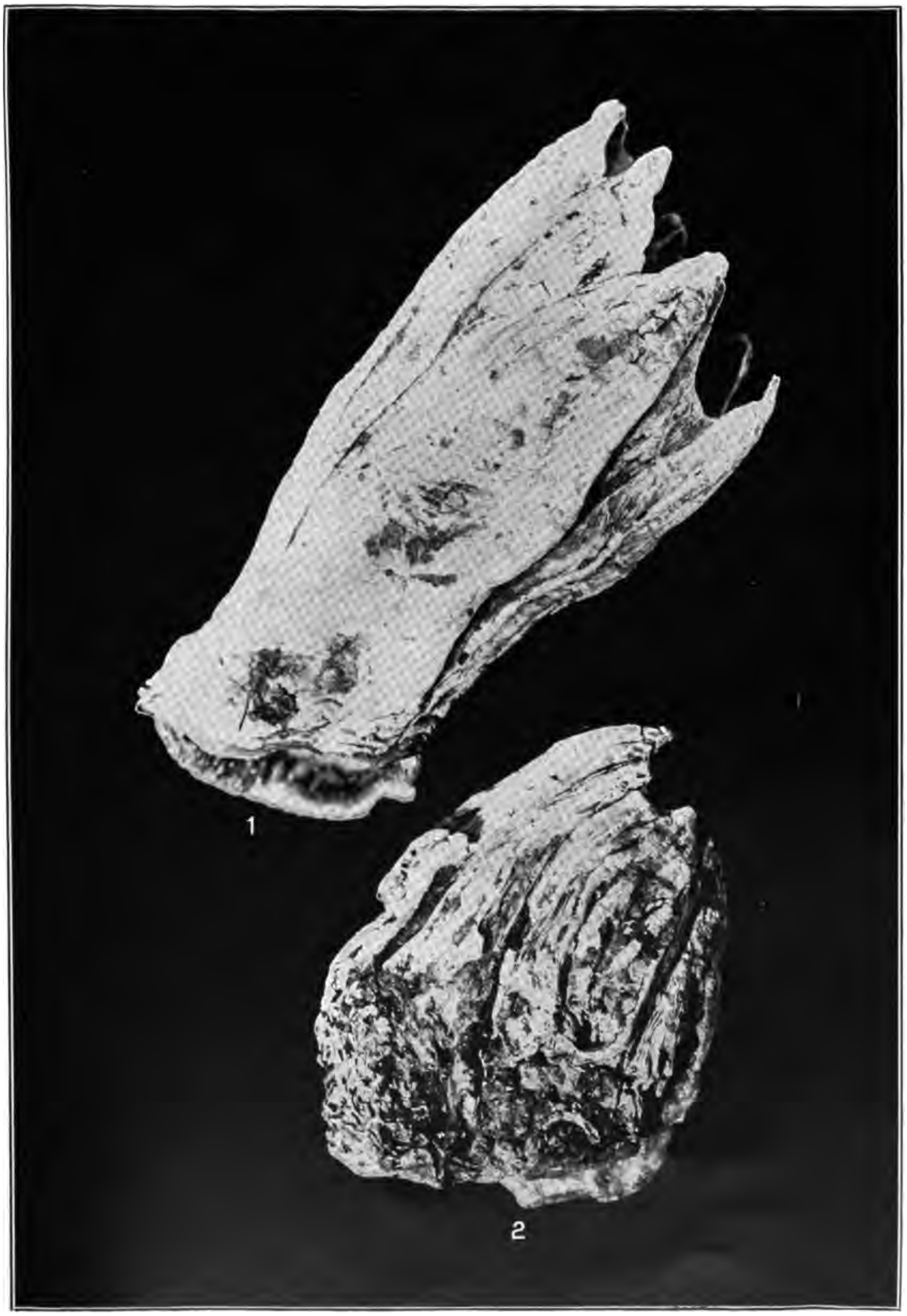

1. *Balanus evermanni.*
2. *Balanus aquila.*

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NOTES ON FISHES OF HAWAII, WITH DESCRIPTIONS OF NEW SPECIES.

By DAVID STARR JORDAN and JOHN OTTERBEIN SNYDER.

BUREAU OF FISHERIES DOCUMENT NO. 623.

NOTES ON FISHES OF HAWAII, WITH DESCRIPTIONS OF NEW SPECIES.

By DAVID STARR JORDAN and JOHN OTTERBEIN SNYDER.

In the month of March, 1905, the senior author made a brief visit to Honolulu. The markets were inspected each day, and a number of species of fishes were collected. Since the date of the collections of Jordan and Evermann in 1901 and of Gilbert and Snyder in 1902, the markets of the city have become very greatly extended. The business of fishing has fallen more fully into the hands of Japanese, and the results of line-fishing in deep water off the coast of Molokai have become a prominent feature of the market. Among the species formerly rare, but now commonly seen in the market, are the following:

Etelis evurus.
Etelis marshi.
Chætopterus dubius.
Rooseveltia brighami.
Erythrichthys schlegeli.
Merinthe macrocephala.
Mulloides pflugeri.

The following species in this collection, listed with the numbers under which their respective types are registered in the U. S. National Museum, seem to be new to science:

Caranx dasson, no. 57782.
Ariomma evermanni, no. 57783.
Rooseveltia aloha, no. 57784.
Thalassoma neanis, no. 57785.
Scaridea aerosa, no. 57786.

The accompanying drawings of these species are the work of Mr. William Sackston Atkinson.

Family OPHICHTHYIDÆ.

1. **Microdonophis polyophthalmus** (Bleeker).

Head 4.5 in the trunk, 4.9 in tail; depth 2.4 in head; snout 5; eye 1.8 in snout; cleft of mouth about 3 in head; teeth sharp, in a single row on jaws and vomer; origin of dorsal above base of pectoral, height of fin equal to width of interorbital space or length of snout; anal about half as high; pectoral rounded, about equal in length to snout. Tail sharply pointed. Color brownish above, white on ventral surface; side with 3 rows of large alternating dark-brown spots, those of the upper row and many of the median ones with white centers (in one specimen 2 or 3 spots of the lower row have white centers, while in another only those of the upper and the anterior ones of the median row are so marked); ventral surface with 2 rows of spots, indistinct on belly, prominent along base of anal; head with many well-defined ocelli, which grow smaller anteriorly, those on the snout being minute and densely crowded; dorsal with a row of ocelli along its base, each ocellus corresponding in position with the spots along lateral line; above the ocelli and alternating with them a row of narrow dark bars; anal immaculate; pectoral dusky at base.

Two specimens, each about 21 inches long. This species is new to Hawaii.

2. **Microdonophis fowleri** Jordan & Evermann.

One specimen. Head 3.8 in in trunk, not 4.8, as stated in the original description.

Family MURÆNIDÆ.

3. **Echidna tritor** (Sauvage).

Several large eels of the type of *Echidna zonata* Fowler were seen in the market together, evidently taken at the same time. Two of them were preserved. One of these has many bands on the body, corresponding to the type of *Echidna psalion*. The other showed 2 or 3 bands on the tail only, and corresponds nearly to *Echidna leihala*. Specimens not preserved showed various intermediate characters. These comparisons leave little doubt of the identity of the nominal species of *Echidna zonata*, *vincta*, *psalion*, *zonophæa*, *leihala*, and *obscura*, and probably all are forms of the species without bands, still earlier described as *Pœcilophis tritor* by Sauvage. It is not improbable that all are again identical with *Echidna polyzona* (Richardson) of the East Indies.

Family SPHYRÆNIDÆ.

4. **Sphyræna helleri** Jenkins.

This species, known as *kawalea*, never as *kaku*, grows to a length of about 3 feet. Its scales are small, 130 to 135 in number. The back is steely olive, with 2 light yellow stripes along each side, which fade with age. In the recent report of Jordan & Evermann [a], this species is stated to abound n the mullet ponds. The statement is not correct. It should be applied to the young of *Sphyræna snodgrassi*, which is called *kaku* and which does great injury to the mullet.

5. **Sphyræna snodgrassi** Jenkins.

This species, called *kaku*, is known by its large scales, there being about 85 in lateral line. It reaches a much larger size than the *kawalea*, often attaining the length of 6 feet. The young of small size are often taken near shore, especially in the mullet ponds.

This huge barracuda is allied to the giant barracuda of the West Indies, *Sphyræna barracuda*. It is probably not the same as the East Indian *Sphyræna commersoni*.

Family MUGILIDÆ.

6. **Chænomugil chaptalii** (Eydoux & Souleyet).

Myxus pacificus Steindachner appears to be the young of this species. The teeth are in narrow bands, in some cases there being but 2 or 3 irregular rows, or occasionally but 1 row on parts of the lower jaw. The teeth are trilobed.

Family HOLOCENTRIDÆ.

7. **Ostichthys pillwaxi** (Steindachner).

One fine specimen of this rare species.

8. **Holocentrus sammara** (Forskål).

Two examples, measuring each 4 inches long, have the spots on the scales so faint as to be hardly discernible.

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[a] Bull. U. S. Fish Commission, vol. XXIII, 1903, pt. I, p. 143, 1905.

Family PSENIDÆ

9. **Ariomma evermanni** Jordan & Snyder, new species. (Fig. 1, text.)

A second species of this peculiar genus is represented by one badly preserved specimen. It differs from *Ariomma lurida* in having a smaller head, shorter snout, smaller eyes, shorter gillrakers, and larger scales. The head is apparently naked and the caudal is forked, characters which both species may, however, possess in common. The anal rays are evidently preceded by two spines in *A. evermanni.*

Head 3.4 in length measured to base of caudal; depth 4; depth of caudal peduncle 5.5 in head; eye 3.7; snout 3.3; interorbital space 3.3; dorsal XI-I, 15; anal II, 15; pectoral 25; scales in lateral series about 38.

Snout blunter and slightly more rounded than that of *A. lurida;* caudal peduncle short and cylindrical; interorbital space very convex; eyes with thin adipose lids; maxillary not freely protractile, rounded posteriorly, about equal in length to diameter of eye, almost entirely concealed beneath a broad, pendant, preorbital flap; jaws equal, each with a single row of minute teeth; vomer and palatines without teeth; tongue large and smooth; gillrakers 7+19, short, slender, and pointed; pseudo-branchiæ present; nostrils near tip of snout.

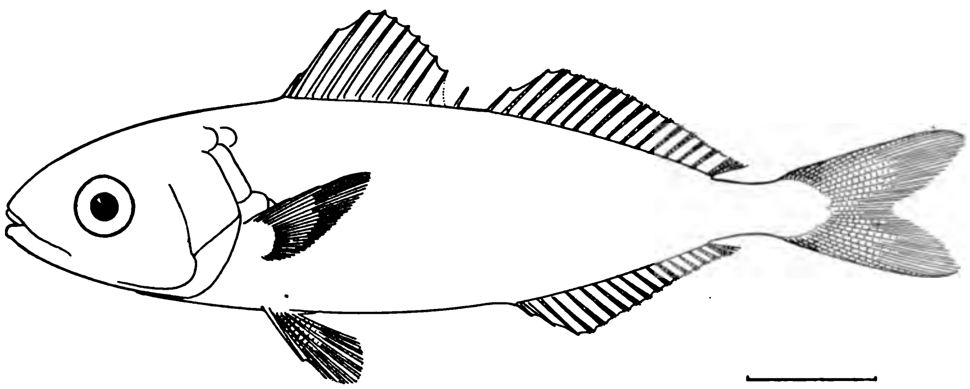

FIG. 1.—Ariomma evermanni Jordan & Snyder, new species. Type.

Head naked; scales of body large, cycloid, very small on caudal peduncle, extending forward on occipital part of head almost to a point above posterior margin of eye.

Origin of dorsal above posterior edge of base of pectoral; the spines slender, the longest (third or fourth) contained 2.2 times in length of head; spinous and soft dorsals apparently connected by membrane; base of anal long, nearly equal to length of head; first 2 rays small and spine-like; last ray of dorsal and anal pencillated, nearly disconnected like the finlets of *Oligoplites*, these fins extending an equal distance posteriorly; pectoral 2 in head; ventrals pointed, 2.3 in head; caudal forked, the lobes pointed, 1.4 in head.

Color, probably dusky; opercle with a large blackish patch; lining of gill-chambers black; mouth light.

Type, no. 57783 U. S. National Museum, measuring 8 inches in length; from the market at Honolulu.

Named for Dr. Barton Warren Evermann, assistant in charge, Division of Scientific Inquiry, U. S. Bureau of Fisheries, in recognition of his work on Hawaiian fishes.

This genus does not belong to the *Apogonichthyidæ*. It seems rather to be an ally of *Cubiceps*, in the group usually called *Nomeidæ;* but as the generic name *Nomeus* ought properly to give way to *Gobiomorus*, we may call the group *Psenidæ*. It differs from *Stromateidæ* chiefly in the separation of the dorsal fins.

We may note here that the Hawaiian species of *Germo*, described on page 174 of the Hawaiian report, is *Germo macropterus* (Schlegel), not *Germo germo*. The figure is of the latter species.

Family CARANGIDÆ.

10. **Caranx dasson** Jordan & Snyder, new species.[a] (Fig. 2, text.)

Head 3.5 in length to base of caudal; depth 3.1; depth of caudal peduncle 7 in head; eye 4; snout 2.6; interorbital space 3.2; dorsal VII-I, 25; anal II-I, 21; scutes 22.

Dorsal contour not greatly elevated, the outline rather gently curved from snout to origin of dorsal; interorbital region elevated, with a rather sharp ridge; snout long, pointed; lower jaw somewhat shorter than the upper; maxillary with supplemental bone, extending posteriorly to a point below anterior margin of eye, its free edge concave; premaxillary protractile; teeth in jaws minute, sharply pointed, rather widely spaced; those of vomer and palatines in villiform bands; a narrow band on tongue; lips thick, their surfaces covered with short, stumpy papillæ; edge of preorbital sharp, overhanging upper edge of maxillary and part of lip, its width posteriorly less than that of maxillary; lateral line arched somewhat more than dorsal contour; 22 scutes on straight portion, the scutes largest on caudal peduncle where they form a high, sharp ridge; opercles and sides of occipital region scaled; throat, chin, snout, upper part of head and a narrow space extending backward to base of dorsal fin naked; body completely scaled; eye surrounded with a broad rim of adipose tissue; opercle and preopercle with membranous edges; third dorsal spine longest, 2.1 in head; first and second spines very weak, the second almost as long as third; soft dorsal and anal of nearly equal length, the rays not greatly elongate, the longest 3.2 in head, each fin with a posterior finlet which is not detached; a high membranous, finely scaled sheath along bases of fins; pectoral falcate, 2.8 in length, extending to a point above base of seventh anal ray; tip of fin formed by fourth and fifth rays; ventral pointed, 2.6 in head; caudal deeply forked, lobes sharply pointed, the membrane scaled, 1.2 in head. Color silvery, dorsal and anal dusky, anterior part of soft dorsal and anal blackish.

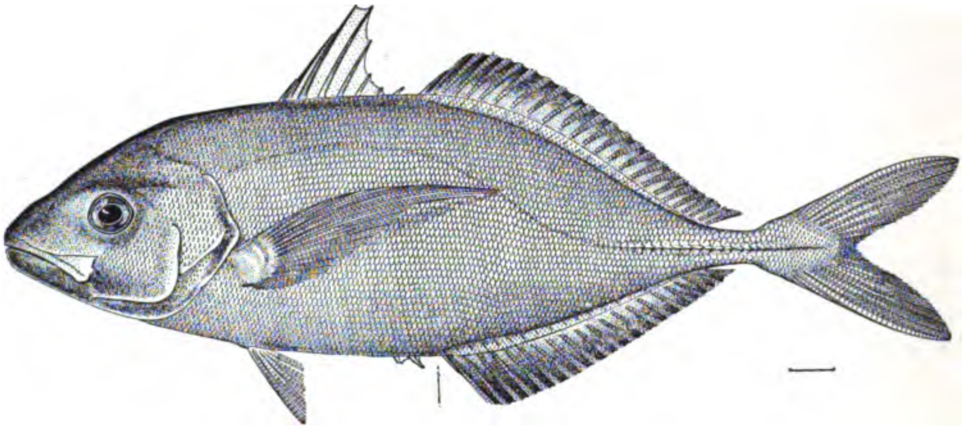

FIG. 2.—Caranx dasson Jordan & Snyder, new species. Type.

One specimen, 21 inches long, type no. 57782, U. S. National Museum; from Honolulu market.

In the report on the Fishes of Samoa (p. 230) a *Caranx thompsoni* Seale is listed from Hawaii. This is a manuscript name only and should have been suppressed.

11. **Decapterus pinnulatus** (Eydoux & Souleyet).

(*Decapterus canonoides* Jenkins.)

The common *Decapterus of* Hawaii has no golden shades whatever in life. It is not identical with the Japanese *Decapterus muroadsi*, and it is very doubtful whether either is the same as the Atlantic species, *Decapterus sanctæ-helenæ*.

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[a] Listed in Jordan & Seale, Fishes of Samoa, Bull. U. S. Bureau of Fisheries, vol. XXV, 1905 (Dec. 15, 1906), p. 231, but not hitherto described.

Family BRAMIDÆ.

12. **Collybus drachme** Snyder.

A fine cast of this species is in the Bishop Museum.

Family SERRANIDÆ.

13. **Caprodon schlegeli** Günther. (Pl. xii, fig. 1.)

A single example from Honolulu, measuring 17.25 inches. On comparing this with a specimen about 10 inches long from Misaki, Japan, we find no differences except that the Honolulu example has a broader maxillary and stronger teeth, characters probably due to age.

Head 3.5 in length to base of caudal; depth 2.8; depth of caudal peduncle 2.9 in head; eye 4.1; interorbital space 3.2; snout 3.4; maxillary 1.9; dorsal x, 21; anal iii, 8; scales 7–70–22.

Dorsal outline evenly curved and considerably elevated; interorbital space convex, extending to a point below posterior edge of pupil; width of maxillary contained 4.7 times in head, its free edge rounded; cleft of mouth oblique; lower jaw very strong, projecting beyond the upper, so that the anterior teeth are exposed; premaxillaries freely protractile; upper jaw with bands of minute, strong teeth, a group of large canines in front and a single row of smaller ones extending posteriorly; toothed area narrow along sides of jaw, but abruptly broadening into large pads on either side anteriorly; teeth of lower jaw in a narrow band posterior to edges of valve, in 2 large elevated pads on each side anteriorly; a naked space between upper pads of teeth, the lower ones more closely apposed; broad patches of fine teeth on tongue, vomer, and palatines; edge of preopercle feebly denticulate, almost smooth; opercle with 2 broad, flat spines; gillrakers 23 + 6, the longest contained 2 times in longitudinal diameter of eye, their tips blunt; lateral line continuous, evenly curved from upper edge of gill opening to a point below posterior dorsal ray, where it rather abruptly turns backward, much as usual in sciænoid fishes, extending along caudal peduncle a little above the middle; head and body, except lips, throat, and edges of maxillary, completely covered with ctenoid scales; many scales on head and upper parts of body, with a minute scale at base; small scales on bases of fins and extending far out on the membranes, those at base of spinous dorsal forming a distinct sheath; dorsal spines strong, the fourth to seventh longest, 2.8 in head; posterior rays longest, 2.1 in head; second and third anal spines very heavy, their length 3.6 in head, the longest ray 2.2 in head; caudal truncate or slightly concave, its length 1.5 in head; pectoral unsymmetrical, the upper rays shortened and the eighth to thirteenth rays markedly elongate, slightly longer than head, their tips broad and flat, the free edge of upper half of fin concave; ventral rounded, the length 1.6 in head.

Color, in formalin: Yellowish with a slight tinge of olive; scattered scales on upper parts orange or pinkish, in places clustered so as to form clouds of either tint; a well-defined pink bar extending from eye to tip of snout; a similar bar passing over interorbital area; rays of caudal pink; membrane yellow; dorsal and anal yellow, the scaled portion of former clouded with pink and yellow, of the latter with pink; ventral spine pink; rays yellow; pectoral light.

When fresh this specimen was fine crimson mixed with yellow; a crimson stripe before eye, one between eyes; preorbital crimson; space before dorsal golden; caudal, anal, ventrals, and pectorals bright yellow, with some crimson mixed in on the base of caudal, of anal, and on sides; lower jaw crimson; crimson mottling on sides of back conspicuous.

The genus *Caprodon* is distinguished from *Odontanthias* and other *Anthiinæ* with teeth on the tongue by the unsymmetrical pectoral, the truncate caudal, the presence of a scaly dorsal sheath, and by the many-rayed soft dorsal. The dorsal spines are none of them elevated, and the dentition offers some peculiarities.

Family LUTIANIDÆ.

Genus ROOSEVELTIA Jordan & Evermann.[a]

Rooseveltia Jordan & Evermann, in Jordan & Seale, Fishes of Samoa, Bull. Bureau Fisheries, vol. xxv, p. 265, 1907; No description (type, *Serranus brighami* Seale).

This genus related to *Apsilus* and *Lutianus*, from which it differs in having the top of the head without the elevated crests characteristic of those genera. The top of the cranium is narrow and convex; the skull is thick, with three obtuse, longitudinal ridges and two grooves separating them; back elevated; no teeth on tongue. The genus contains two known species, *Apsilus brighami* (Seale), and the new species *Rooseveltia aloha* Jordan & Snyder.

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[a] Name occurs in Jordan & Seale, Fishes of Samoa, but no description hitherto published.

This new genus is named for Theodore Roosevelt, eminent as a naturalist and as a promoter of the scientific work of the various scientific bureaus of the Government of the United States.

The genera of *Etelinæ*, distinguished by the uncrested cranium, may be thus compared:

- I. Dorsal fin continuous.
  - *a.* Canine teeth strong; body fusiform; no teeth on tongue (=*Pristopomoides*=*Sparopsis*), type *virescens*. ....APRION.
  - *aa.* Canine teeth very weak; back more elevated.
    - *b.* Top of cranium broad, flattish, becoming more convex with age.
      - *c.* Tongue toothless.
        - *d.* Body subfusiform, the depth 4 in length (*violescens*)..........BOWERSIA.
        - *dd.* Body deeper, compressed, the depth 3 in length (*macrophthalmus*)..........PLATYINIUS.
      - *cc.* Tongue with a patch of villiform teeth; body subfusiform (*dubius*)..........CHÆTOPTERUS.
    - *bb.* Top of cranium narrow, convex, the skull thick, with three obtuse longitudinal ridges separated by shallow grooves; no teeth on tongue; back elevated..........ROOSEVELTIA.
- II. Dorsal fin divided.
  - *e.* Cranium not cavernous; skeleton firm; color red.
    - *f.* Maxillary scaly.
      - *g.* Opercle without spine (*carbunculus*)..........ETELIS.
      - *gg.* Opercle with spine, (*berycoides*)..........ETELISCUS.
    - *ff.* Maxillary naked; opercle with a spine (*aquilionaris*)..........ETELIDES.
  - *ee.* Cranium cavernous; skelton soft; color black..........VERILUS.

In *Apsilus* and *Tropidinius*, as in *Lutianus*, the top of the cranium has three sharp ridges. No species of *Apsilus* is known from Hawaii.

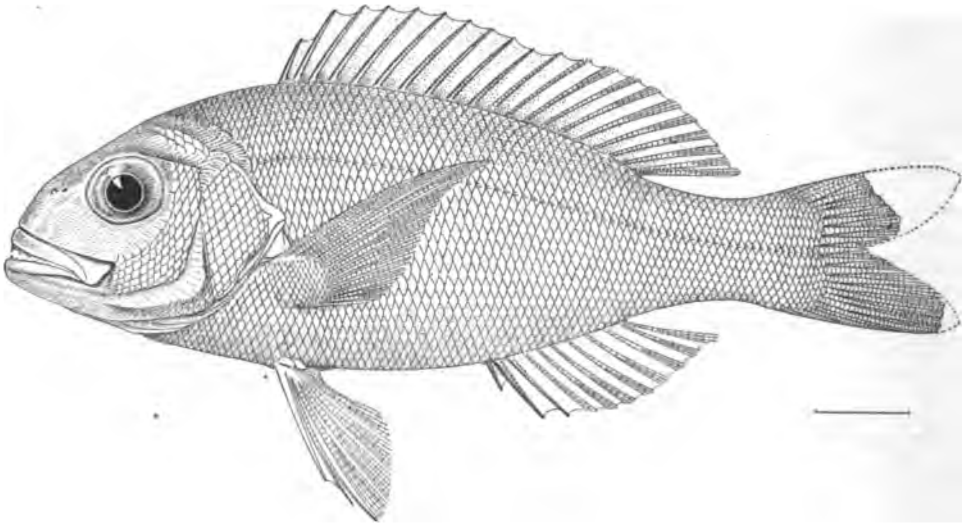

FIG. 3.—Rooseveltia aloha Jordan & Snyder, new species. Type.

14. **Rooseveltia aloha** Jordan & Snyder, new species.[a] (Fig. 3, text.)

This species differs markedly from *R. brighami* in having a much larger eye and a very narrow preorbital, the width of the latter being somewhat less than half the diameter of eye. *R. aloha* is without the transverse yellow bands characteristic of *R. brighami*.

Head 2.9 in length to base of caudal; depth 2.7; eye 3.5 in head; snout 2.7; interorbital space 4; preorbital 7.5; maxillary 2.5; dorsal x, 11; anal III, 8; scales 7–67–16.

Body deeper, the dorsal contour more elevated, the snout shorter, than in *R. brighami*; eye large, high up, with a swollen cutaneous rim above; interorbital area somewhat convex; suborbital narrowest above corner of mouth; maxillary extending to a point below anterior edge of pupil; lower jaw projecting slightly beyond upper; jaws each with a row of enlarged canines, behind which is a band of villiform teeth, among which are a few slightly enlarged ones; narrow bands of minute teeth on vomer and palatines; tongue smooth; gillrakers 3+10, long, slender, and pointed; dorsal inserted directly above tip of opercular spine, the spines slender, stiff and pungent, the first spine not quite half the height of second; longest (third to fifth) spine 2.7 in head; no notch between spinous and soft dorsal, rays about equal to spines in length; anal not quite so high as dorsal, the spines heavier and shorter; first spine slightly more than one-third length of the third, the latter 3.5 in head; ventral pointed, extending slightly beyond vent; dorsal, anal, and ventral without scales; pectoral falciform, extending to a point above origin of anal, its base with minute scales; caudal deeply forked, the rays with scales (the rays being broken, their length can not be determined). Scales finely ctenoid; a row of enlarged soft scales extending from upper edge of opercle to nape; a row of similar scales below eye; cheeks and opercles with scales; maxillary, preorbital, snout, and interorbital naked; preopercle smooth, the edge serrated; opercle with a flat, pointed spine at the upper angle; lateral line curved much like the contour of back. No distinctive color-markings in an alcoholic specimen, except numerous obscure mottlings and minute spots of a deeper color, which may have been greenish on a red background, and a subdued dark dash on opercle. The appearance of the specimen, extended stomach, etc., indicates that it came from deep water.

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[a] Listed in Jordan & Seale, Fishes of Samoa, Bull. U. S. Bureau of Fisheries, vol. XXV, 1905 (Dec. 15, 1906), p. 265, but not hitherto described.

Type, no. 57784 U. S. National Museum, about 11 inches long, collected by Jordan and Evermann at Honolulu, 1901, and by some oversight not distinguished at the time from *Rooseveltia brighami.*

15. **Rooseveltia brighami** (Seale). *Ukikiki; Kalikali.*

Serranus brighami Seale, Occasional Papers Bishop Museum, vol. I, no. 4, 1901, 7, Honolulu.

Apsilus brighami, Jenkins, Bull. U. S. Fish Comm., vol. XXII, 1902 (Sept. 23, 1903), 452; Honolulu. Snyder, ibid. (Jan. 19, 1904), 527; Honolulu. Jordan & Evermann, Bull. U. S. Fish Comm., vol. XXIII, 1903 (July 29, 1905), 233, pl. XVI; Honolulu; Kailua.

This species, having the top of the head without the elevated crests characteristic of *Lutianus* and *Apsilus,* should not have been referred to *Serranus* nor to *Apsilus.*

16. **Chætopterus dubius** Günther.

(*Aprion microdon* Steindachner.)

(*Bowersia ulaula* Jordan and Evermann,)

A specimen 15 inches long, from the market at Honolulu, seems to differ in no way from a Japanese example collected at Fukaura.

Head 3.4 in length; depth 3.6; snout 3.8; interorbital 3.3; preorbital 10.5; maxillary 2.9; dorsal X, 11; anal III, 8; scales in lateral series 70; between lateral line and anal 14. Basihyal with an oval patch of villiform teeth on its posterior half.

This specimen corresponds evidently to *Bowersia ulaula* of Jordan and Evermann; and the number of scales in the lateral line in *Aprion microdon,* as described by Steindachner, shows that his species is *C. dubius* rather than *Bowersia violescens.* This species is known as *opakapaka* in the markets, not being distinguished from the equally common *Bowersia violescens* by the fishermen. *Ulaula,* very red, is the name of *Etelis evurus* and *Etelis marshi.*

17. **Bowersia violescens** Jordan & Evermann.

(*Apsilus microdon* Jordan & Evermann, young; not *Aprion microdon* Steindachner.)

The small specimens described by Jordan and Evermann as *Aprion microdon* are the young of *Bowersia violescens.* We find no teeth on the tongue in any of these and none in a cotype of *Bowersia violescens.* The genus *Bowersia* is therefore to be separated from *Chætopterus* by the absence of these teeth, not by their presence, as originally stated. The teeth are present in *Chætopterus dubius.* The absence of lingual teeth, therefore, the smaller mouth, and especially the larger scales, separate *Bowersia violescens* from *Chætopterus dubius.*

18. **Etelis evurus** Jordan & Evermann.

This species, with its congener, *Etelis marshi,* is common in the winter markets, and both are known as *ulaula* (very red). The two species differ widely from each other and a study of the skeletons will probably place them in different genera.

Family MULLIDÆ.

19. **Mulloides pflugeri** Steindachner.

Many very large specimens of 3 to 4 pounds weight were seen in the market. These were uniform deep crimson red in color, without yellow or black shadings or markings. They were called *weke-ula*, or red mullet. It is possible that *Mulloides flammeus* of Jordan and Evermann, with crimson cross-bands, may be the young of *Mulloides pflugeri*.

We may here note that *Upeneus preorbitalis* Smith & Swain (p. 263, Hawaiian report), is identical with *Mulloides samoensis günther*.

Family LABRIDÆ.

20. **Thalassoma neanis**, Jordan & Evermann, new species. (Pl. XII, fig. 2.)

Head 3.5 in length to base of caudal; depth 3.7; depth of caudal peduncle 7; eye 5.5 in head; snout 2.6; interorbital space 4.2; dorsal VIII, 13; anal III, 11; scales 3-27-8.

Interorbital space convex; snout somewhat pointed; tip of snout to occiput 4.3 in length; lips large and comparatively thick, the lower one with two thin lateral, pendent folds; jaws each with a single row of closely apposed, sharp, conical teeth, which grow successively smaller from before backward, the anterior tooth on each side enlarged and directed forward; cleft of mouth equal to width of preorbital; gillrakers, 6 + 14, sharply pointed, small, those near ends of arches very minute; head naked, except a small patch of 4 or 5 scales on upper limb of opercle; scales thin, with soft membranous edges; lateral line complete, following contour of back to a point below tenth dorsal ray, where it abruptly bends downward, passing along middle of caudal peduncle, and ending on base of caudal fin; origin of dorsal above base of pectoral, the distance between base of first spine and naked portion of head equal to half the distance between the latter point and tip of snout; soft dorsal slightly higher than the spinous, the length of longest ray contained about 2.3 in head; dorsal and anal extending an equal distance posteriorly, the latter with three strong spines, the rays slightly shorter than those of the dorsal; caudal about equal to head in length, lunate, the lobes acutely pointed; ventral pointed, 2 in head; pectorals rounded, 1.3 in head.

Color, in formalin, when first received, almost fresh; head dark bluish gray, or purplish, becoming yellowish on occiput and opercle, marked with irregular stripes about equal in width to diameter of pupil; the upper stripe passing from snout to eye, above which it curves, then extending backward and fading out on fifth or sixth scale of lateral line; another extending from corner of mouth to eye, curving below it and passing obliquely downward and backward to a point on opercle below its angle, from which point it borders the edge of the latter, then curves forward and reaches preopercle; cheek with a round spot, apparently an interruption of the same stripe; another stripe begins near this and continues forward and downward to a point posterior to corner of mouth, returning along ventral region of side of head to edge of subopercle; a median stripe extends from middle of orbit backward, curving downward to angle of opercle; chin with a transverse stripe; all these stripes are light green on side of head, bluish on ventral parts, all narrowly bordered with blackish violet; lips pale reddish yellow; breast blackish with two faint dark-edged greenish stripes on each side below pectorals; body bright citron yellow, dusky on breast; a broad area of sky blue extending downward from bases of first to seventh dorsal spines, narrowing somewhat on side, then growing broader posteriorly and extending backward to end of anal fin so that most of the belly is blue; basal portion of dorsal and anal bright yellow, the distal part sky blue, the tips of the rays again tinged with yellow, the blue and yellow areas separated by a narrow blue-black streak; a small dark spot behind second dorsal spine; pectoral yellow, greater part of posterior half of fin black, a narrow triangular blackish blotch at base; ventrals pale yellow; caudal yellow, the upper and lower edges greenish; no vertical markings on the individual scales.

The specimen is an adult male. Type no. 57785 U. S. National Museum, 7 inches long, from the market at Honolulu.

21. **Thalassoma lutescens** (Solander).

In the collections of 1901 was obtained a fine male specimen of a *Thalassoma* in form almost exactly like *T. neanis*, but quite different in color. This specimen, in Jordan and Evermann's report (Bull. U. S. F. C., XXIII, p. 303), is described as *Thalassoma lunare*, but on comparison with the true *lunare* from the Philippines we feel sure that it can not be the same. It evidently corresponds to *Thalassoma lutescens* (Solander) from Tahiti, a species which we think certainly distinct from *Thalassoma lunare*. *Thalassoma neanis* and *Thalassoma lutescens* have much in common, but they seem to be distinct species, differing in the arrangement of colors. *T. neanis* lacks entirely the dark cross streaks on the scales characteristic of *T. lunare* and *T. lutescens*.

22. **Anampses godeffroyi** Günther. (Pl. XIII, fig. 1.)

(*Anampses evermanni* Jenkins.)

Several specimens of a large blue *Anampses* were seen in the market, and one of these was preserved. This is evidently the species called *Anampses godeffroyi* by Günther from a drawing made at Hilo by Mr. Garrett. The bluish reticulations of the head are finer, more numerous, and not broken as figured by Garrett, the vertical bars on the scales are more elongate, the stripes of blue on dorsal and anal narrower, and those on the caudal more elongate. The entire head and body blue or greenish-blue in life, strongly suffused with a tinge of reddish brown; head covered with dark greenish blue reticulations, each about one-third the width of pupil; lips reddish; each scale with a vertical blue bar slightly narrower than the reticulations on opercle, the bars generally connected, forming lines extending across the body; bars reduced on caudal peduncle forming oval or round spots; dorsal and anal same color as body, broadly edged with deep blue, the membrane with 4 longitudinal narrow stripes, those of the dorsal somewhat irregular; caudal reddish orange with stripes which are more or less broken up into oval and circular spots, the fin broadly edged above and below with deep blue; pectoral and ventrals reddish orange, the former greenish blue at base and along upper edge, the latter having the spine greenish blue and the membrane sparsely marked with elongate blue spots.

The specimens called *Anampses godeffroyi* by Jordan & Evermann, and thought to be distinct from *A. evermanni*, differ somewhat in color from the above and may possibly be distinct, as was supposed when they were first taken. After the specimen here described had been in formalin a short time the pale horizontal stripes described by Jordan & Evermann made their appearance. Other alleged color differences between *A. evermanni* and *A. godeffroyi* are relative, the vertical lines on the scales varying somewhat in width and length, and the caudal stripes being broken up into variously elongated spots.

It is probable therefore that *Anampses evermanni* is a synonym of *Anampses godeffroyi*, and that the reddish shades on the body, seen in life, fade with removal from the water, the blue being more permanent.

23. **Gomphosus sandwichensis** Günther.

In the Bishop Museum is a specimen of *Gomphosus*, with a colored cast of the same specimen. The species is much like *Gomphosus tricolor*, but it is apparently not the same, and the black opercle indicates that it is *Gomphosus sandwichensis* Günther, a doubtful species referred by Jordan & Evermann to the synonymy of *Gomphosus tricolor*.

The cast is green, the upper part of the snout pink-red; a sharp red line behind eye; a black blotch on opercle; base of pectoral yellow; the fin green with a blue-black distal area; dorsal green, a narrow sharp red stripe along its middle; base of caudal purple, the rest green.

Family SCARICHTHYIDÆ.

24. **Scaridea aerosa** Jordan & Snyder, new species. (Fig. 4.)

This species differs markedly from the other Hawaiian members of the genus in having a broad, vertical brassy band posterior to the pectoral fin, and also in the character of the anterior profile, which is decidedly elevated over the eye.

Head 3.3 in length to base of caudal; depth 2.8; depth of caudal peduncle 2.2 in head; eye 4.5; snout 2.8; interorbital space 4.2; scales 23, 8; dorsal IX, 10; anal III, 9.

Snout blunt, the anterior outline steep between tip of snout and interorbital space, then sloping gently backward to origin of dorsal; jaws equal; cleft of mouth extending to a point below anterior edge of orbit; upper lip double for nearly half its length, the lower one for only about one-fourth;

teeth of upper jaw on outer edge of dental plate, alternating, in 2 series for about half length of jaw, where they are followed by a single strong curved canine which projects outward and backward; below and posterior to the canine the dental plate bears on its surface a row of small blunt teeth; lower jaw with 3 rows of teeth anteriorly, 2 laterally, and 1 posteriorly, all on outer edge of dental plate, which has a rather rough flat surface within the rows of teeth; dorsal spines stiff and sharp, the first (longest) contained about 2.5 times in head, rays somewhat shorter, there being but little difference in the height between the spinous and soft dorsals; anal spines 3, small and slender, the soft rays nearly equal in height, 2.6 in head; dorsal and anal extending an equal distance posteriorly; ventral rounded, 1.7 in head; pectoral 1.5 in head; upper lobe of caudal slightly concave, the lower rounded, the middle and upper rays longest, basal portion of fin with large scales; lateral line following contour of back to a point below posterior end of dorsal, where it is abruptly bent downward, passing along middle of caudal peduncle; scales on occiput and on opercles, a single row passing obliquely downward on cheek below eye; a series of 4 scales anterior to origin of dorsal fin.

Color dusky, indistinctly mottled with lighter and darker shades; a broad diffuse band of bright brassy yellow, extending obliquely across the side from between the third and seventh dorsal spines to the anterior end of base of anal; dorsal mottled with blackish; other fins dusky; base of pectoral and chin blackish.

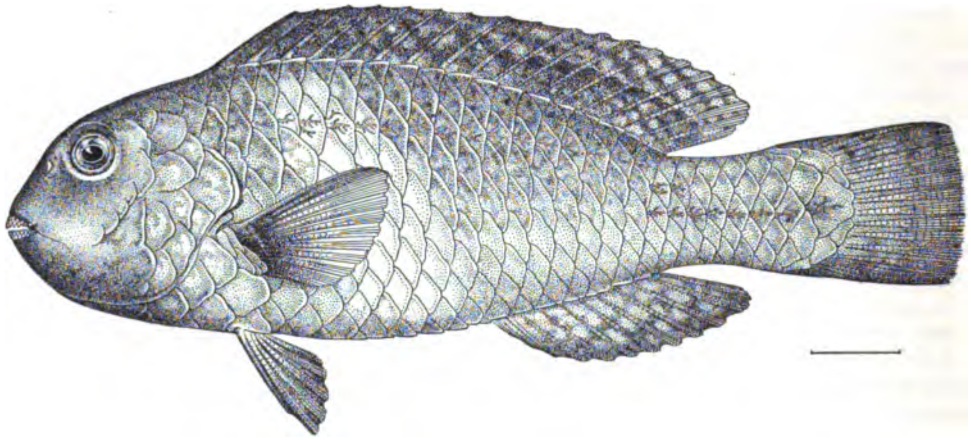


FIG. 4.—Scaridea aerosa Jordan & Snyder, new species. Type.

The type no. 57786, U. S. National Museum, from the market at Honolulu, measures 11.5 inches in length. Another specimen 13.5 inches long, does not differ from the type, except that the teeth are somewhat worn, the canines being broken off; the yellow cross-band is less distinct.

25. **Callyodon perspicillatus** (Steindachner). (Pl. XIII, fig. 2.)

We present a colored plate of this handsome species, taken from a fresh specimen, in which, however, certain evanescent shades, as of golden on the opercular flap and rosy on the base of the dorsal, had faded.

Family CHÆTODONTIDÆ.

26. **Chætodon ephippium** (Bloch).

A cast of this most handsome species, which is rather common in the South Seas, is in the Bishop Museum. The specimen came from Honolulu, and this is the first Hawaiian record.

Probably the name *Zanclus cornutus* should be retained for the common species of *Zanclus*, as *Z. canescens* is probably a distinct species.

Family ACANTHURIDÆ.

27. **Hepatus leucopareius** (Jenkins).

Of this rare species several specimens were in the aquarium at Waikiki. It is called *mai koiko.*

28. **Hepatus matoides** (Cuvier & Valenciennes).

Renewed comparison of specimens leads us to regard *H. guntheri*, *H. xanthopterus* (Cuvier & Valenciennes) and *H. blochi* (Cuvier & Valenciennes) as identical with *Hepatus matoides*. The dark stripes on the dorsal and anal, the yellow on the pectoral, and the pale ring at the base of the caudal all fade more or less in spirits. Renewed comparison of fresh specimens is necessary to settle this point finally.

A fresh specimen corresponding to *H. guntheri* has the body plain brown, a pale ring about tail, yellow on pectoral and about eye; blue and yellow streaks on preorbital; dorsal and anal black with four narrow blue stripes.

Family BALISTIDÆ.

29. **Xanthichthys lineopunctatus** (Holland).

A specimen from Honolulu, the first ever noticed in the market, collected by Mr. Berndt. Our previous specimens came from the island of Hawaii.

Family DIODONTIDÆ.

30. **Diodon nudifrons** Jenkins.

Seen in the aquarium at Waikiki. A black bar from eye downward, meeting its fellow across the throat.

Family SCORPÆNIDÆ.

31. **Merinthe macrocephala** (Sauvage).

This large scorpænoid fish is common in the winter markets, reaching a weight of 3 to 5 pounds. It is brilliant orange in life, with sparse dots and mottlings.

32. **Fierasfer homei** (Richards).

While engaged in a study of the holothurians recently collected near Honolulu by the *Albatross*, Mr. W. K. Fisher found a well-preserved specimen of *Fierasfer homei* in the cloacal chamber of a specimen of a new holothurian of the genus *Stichopus.* It was translucent with many scattered pale brownish spots on the head and body; teeth in narrow bands on the jaws, palatines and vomer; central teeth of the latter elongate, and closely apposed, forming a short ridge. Writers generally have overlooked the presence of a minute though well-developed caudal fin, which is evidently confluent with the dorsal and anal. The specimen measures 5.75 inches in length.

Family GOBIIDÆ.

33. **Quisquilius eugenius** Jordan & Evermann.

In the Hawaiian Report of Jordan & Evermann, p. 483, and in the later Samoan Report of Jordan & Seale, this species is placed by error in the genus *Gobiomorphus* Gill. *Quisquilius eugenius* has the ventrals united. They were, in the type, accidentally torn apart. Canine teeth are present. The genus is related to *Drombus* and to *Amblygobius*, not to *Gobiomorphus* or *Asterropterix.*

In this connection it may be noticed that the genus *Paragobiodon* Bleeker (*echinocephalus*) was named *Rupellia* (*Ruppellia*) by Swainson in 1839, and that the original type of the genus *Apocryptes* of Osbeck and of Cuvier and Valenciennes, was *Gobius pectinirostris* of Linnæus. The species called *Boleophthalmus chinensis* or *pectinirostris* should therefore stand as *Apocryptes pectinirostris.* The genus commonly called *Apocryptes* should probably stand as *Gobileptes* Swainson.

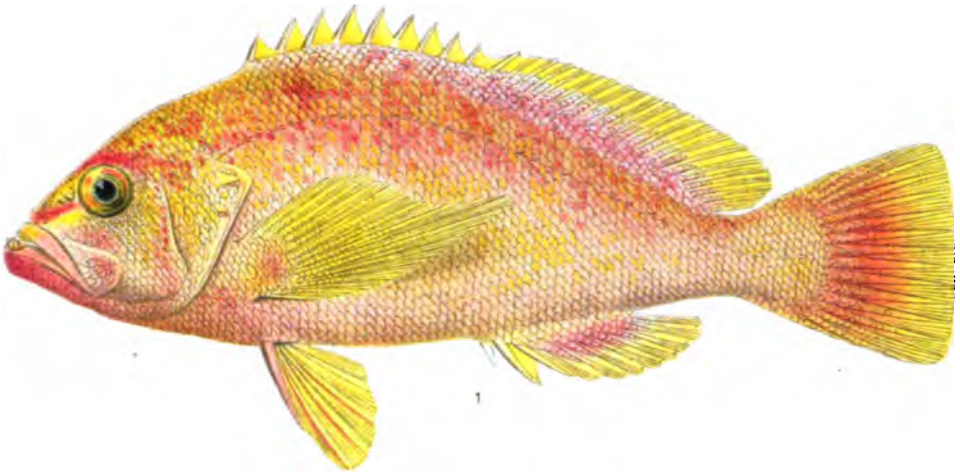
34. **Oxyurichthus lonchotus** (Jenkins).

The Hawaiian species called *Gobionellus lonchotus* by Jenkins and *Gobiichthys lonchotus* by Jordan & Evermann should apparently stand as *Oxyurichthus lonchotus*. *Gobionellus* differs in the notched tongue, and *Gobiichthys* (=*Pselaphias*), by the presence of a cirrus on the upper part of the eyeball.

Family CIRRHITIDÆ.

35. **Goniistius vittatus** (Garrett).

The species called in the Hawaiian report (p. 447), *Cheilodactylus vittatus* should stand as *Goniistius vittatus* (Garrett).



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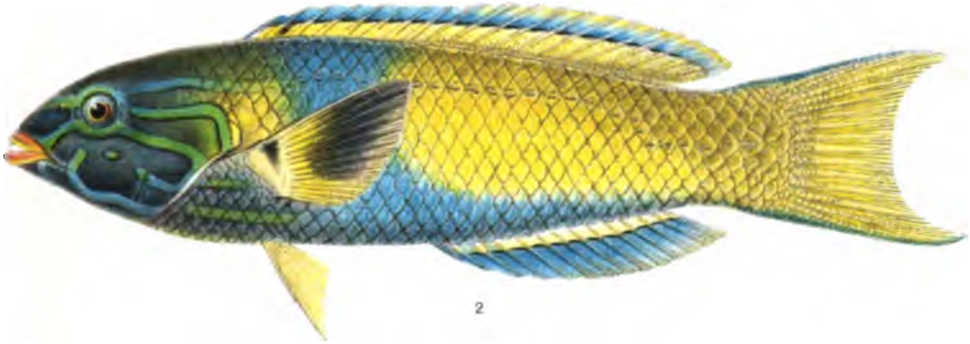
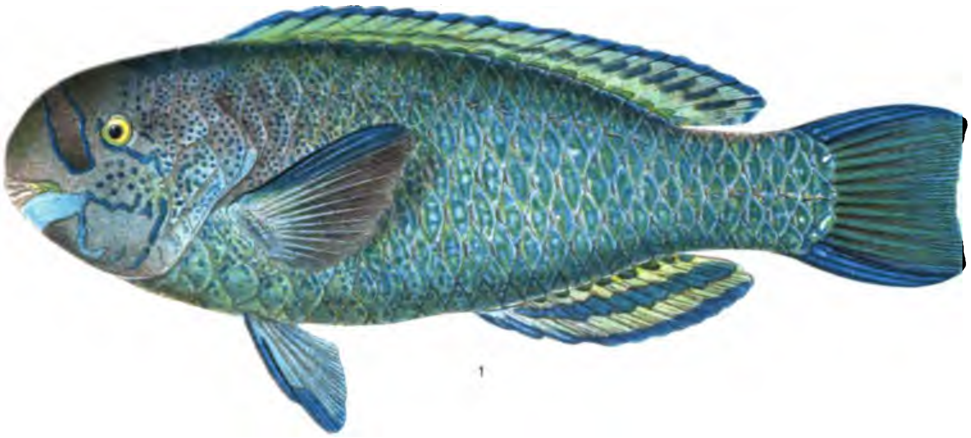


2

A. HOEN & CO. BALTIMORE

1 CAPRODON SCHLEGELI GÜNTHER
2 THALASSOMA NEANIS JORDAN & EVERMANN, NEW SPECIES. TYPE

UNIV. OF



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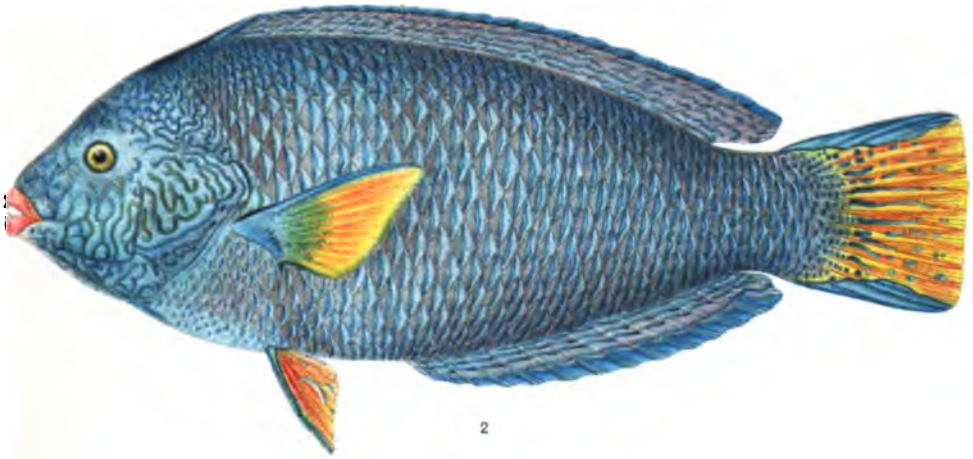

2

A HOEN & CO. BALTIMORE

1 ANAMPSES GODEFFROYI GÜNTHER
2 CALLYODON PERSPICILLATUS (STEINDACHNER)

UNIV OF MICH

THE FISHES OF ALASKA.

By BARTON WARREN EVERMANN and EDMUND LEE GOLDSBOROUGH.

BUREAU OF FISHERIES DOCUMENT NO. 624.

THE FISHES OF ALASKA.

By BARTON WARREN EVERMANN and EDMUND LEE GOLDSBOROUGH.

An investigation of the salmon fisheries of Alaska was made during the summer and fall of 1903 by a special commission appointed by the Commissioner of Fisheries at the request of the President, and a report thereon by David Starr Jordan and Barton Warren Evermann, published January 30, 1904, as House Document No. 477, Fifty-eighth Congress, second session, considered fully all the phases of the salmon fisheries concerning which legislation was urgently needed. Large collections of fishes and other aquatic animals were secured, however, and much information concerning the habits, abundance, and distribution of the salmon and other fishes. It is the purpose of the present paper to put on record the more important of these facts and to discuss more fully some of the chief problems connected with the salmon fisheries.

In order to represent fully the scope of the investigations of the special commission, it has been thought advisable to include in this report the species of fishes obtained during the dredging and other collecting operations in British Columbia and Puget Sound. All species previously recorded from Alaskan waters have been listed also, and all Alaskan specimens in the U. S. National Museum have been examined. Attempt has thus been made to embody in this paper a complete review of the fishes of Alaska to date. The commercial and statistical phases of the fisheries have been fully discussed in reports by Mr. John N. Cobb, assistant agent at the salmon fisheries of Alaska.[a]

The following new species are described in this report. The numbers in parentheses are those of the types as registered in the U. S. National Museum.

Polistotrema deani (57820).
Sebastodes swifti (57821).
Icelinus burchami (57822).
Cottus chamberlaini (57823).
Blennicottus clarki (57824).
Pholis gilli (57827).
Lumpenus longirostris (57828).
Lycodes jordani (57829).

Accompanying this report are 20 colored plates, made from water-color drawings of living fishes. Cuts of all the new species herein described are inserted in the text, as are also numerous others.[b]

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[a] The Commercial Fisheries of Alaska in 1905, and The Fisheries of Alaska in 1906, Bureau of Fisheries Documents Nos. 603 and 618.

[b] The colored drawings and the pen and ink drawings of all but three of the new species were made by Mr. A. H. Baldwin. *Lumpenus longirostris* and *Polistotrema deani* were drawn by Miss Anna S. Buckelew, *Lycodes jordani* by Miss Violet Dandridge.

GEOGRAPHIC DISTRIBUTION OF FISHES IN ALASKA AND THE PUGET SOUND REGION.

For the purposes of the present paper we have considered the territory covered as made up of five divisions, viz:

1. The Puget Sound-British Columbia region, extending northward to Dixon Entrance and Portland Canal.
2. Southeast Alaska, from Dixon Entrance and Portland Canal to Yakutat Bay.
3. Central Alaska, from Yakutat Bay to the Alaska Peninsula and the Aleutian Islands, including Prince William Sound, Cook Inlet, and their connecting waters.
4. Bering Sea, including the Yukon and all other tributary waters in Alaska.
5. Arctic Ocean, including the Mackenzie and all other tributary waters in Alaska.

The geographic distribution of fishes in these regions is represented in the following tabulation, an examination of which shows some interesting facts. The total number of species recorded is 288. Of these, 7 are found in each of the 5 regions; 40 are known from all of the regions except the Arctic; 16 are known from Bering Sea, Central Alaska, and Southeast Alaska, but not from either of the other 2 regions. Twenty-two are peculiar to Puget Sound region, 15 to Southeast Alaska, 14 to Central Alaska, 55 to Bering Sea, and only 1 (*Argyrosomus lucidus*) to the Arctic. There are 11 anadromous and 18 strictly fresh-water species.

The great number of species from Bering Sea shows how much more thoroughly that region has been studied than have Central and Southeast Alaska; it does not necessarily indicate a decidedly richer fauna.

Family and species.	Puget Sd. and Br. Col. reg.	SE. Alaska.	Cent. Alaska.	Bering Sea.	Arctic Ocean.
HEPTATREMIDÆ:					
Polistotrema deani		×			
PETROMYZONIDÆ:					
Entosphenus tridentatus		×	×	×	
Lampetra aurea				×	
SQUALIDÆ:					
Squalus sucklii	×	×	×		
DALATIIDÆ:					
Somniosus microcephalus		×		×	
SQUATINIDÆ:					
Squatina squatina		×			
RAJIDÆ:					
Raja binoculata	×	×	×	×	
parmifera		×	×	×	
aleutica			×	×	
trachura			×		
abyssicola	×				
CHIMÆRIDÆ:					
Hydrolagus colliei	×	×			
ACIPENSERIDÆ:					
Acipenser medirostris	×		×		
CATOSTOMIDÆ:					
Catostomus catostomus				×	
SYNAPHOBRANCHIDÆ:					
Histiobranchus bathybius				×	
NEMICHTHYIDÆ:					
Avocettina gilli		×			
CLUPEIDÆ:					
Clupea pallasii	×	×	×	×	
Alosa sapidissima	×	×	×		
SALMONIDÆ:					
Coregonus kennicotti				×	×
quadrilateralis				×	
nelsoni				×	×
Argyrosomus pusillus				×	×
laurettæ				×	×
lucidus					×
alascanus				×	×
SALMONIDÆ—Continued.					
Stenodus mackenzii				×	×
Oncorhynchus gorbuscha	×	×	×	×	×
keta	×	×	×	×	
tschawytscha	×	×	×	×	×
kisutch	×	×	×	×	
nerka	×	×	×	×	
Salmo clarkii	×	×	×		
gairdneri	×	×	×		
irideus	×	×	×		
Cristivomer namaycush	×			×	
Salvelinus malma	×	×	×	×	×
THYMALLIDÆ:					
Thymallus signifer				×	×
ARGENTINIDÆ:					
Mallotus villosus	×	×	×	×	×
Thaleichthys pacificus	×	×	×	×	
Osmerus thaleichthys	×	×	×	×	
dentex		×	×	×	×
albatrossis			×	×	
Hypomesus pretiosus	×	×	×		
olidus				×	
Leuroglossus stilbius				×	
MICROSTOMIDÆ:					
Bathylagus borealis				×	
MYCTOPHIDÆ:					
Lampanyctus gemmifer		×			
Nannobrachium leucopsarum		×		×	
nannochir	×	×	×	×	
Diaphus theta		×			
CHAULIODONTIDÆ:					
Cyclothone microdon				×	
Chauliodus macowni	×	×	×		
PLAGYODONTIDÆ:					
Plagyodus æsculapius			×	×	
borealis			×	×	
NOTACANTHIDÆ:					
Macdonaldia challengeri				×	

Family and species.	Puget Sd. and Br. Col. reg.	SE. Alaska.	Cent. Alaska.	Bering Sea.	Arctic Ocean.
DALLIDÆ:					
Dallia pectoralis				×	
ESOCIDÆ:					
Esox lucius				×	
GASTEROSTEIDÆ:					
Pygosteus pungitius			×	×	×
Gasterosteus cataphractus	×	×	×	×	
AULORHYNCHIDÆ:					
Aulorhynchus flavidus	×	×			
SYNGNATHIDÆ:					
Siphostoma griseolineatum	×	×			
AMMODYTIDÆ:					
Ammodytes personatus	×	×	×	×	
BERYCIDÆ:					
Plectromus lugubris				×	
cristiceps		×			
ZAPRORIDÆ:					
Zaprora silenus	×				
EMBIOTOCIDÆ:					
Cymatogaster aggregatus	×	×			
Tæniotoca lateralis	×				
Damalichthys argyrosomus	×	×			
SCORPÆNIDÆ:					
Sebastolobus alascanus		×	×	×	
altivelis			×		
Sebastodes paucispinis	×				
melanops	×	×	×		
ciliatus		×	×		
mystinus	×	×	×	×	
brevispinis		×			
alutus	×	×	×	×	
pinniger	×				
aleutianus			×		
saxicola	×	×			
swifti		×			
diploproa	×				
introniger	×	×	×	×	
ruberrimus	×	×			
rosaceus	×				
rupestris	×	×			
dalli	×				
caurinus	×	×			
maliger	×	×			
nebulosus	×	×			
nigrocinctus	×	×			
ANOPLOPOMATIDÆ:					
Anoplopoma fimbria	×	×			
HEXAGRAMMIDÆ:					
Pleurogrammus monopterygius			×	×	
Hexagrammos decagrammus	×	×	×	×	
octogrammus		×	×	×	
stelleri	×	×	×	×	
superciliosus	×	×	×	×	
lagocephalus				×	
Ophiodon elongatus	×	×	×		
Zaniolepis latipinnis	×				
Oxylebius pictus	×				
COTTIDÆ:					
Chitonotus pugetensis	×				
Tarandichthys filamentosus	×				
tenuis	×				
Icelinus burchami		×			
borealis	×	×	×	×	
Astrolytes fenestralis	×	×	×	×	
Steigidinotus latifrons	×				
Artediellus pacificus			×	×	
Rastrinus scutiger			×		
Icelus bicornis			×	×	
spiniger		×	×	×	
euryops			×		
vicinalis				×	
canaliculatus				×	
Radulinus asprellus	×	×			
Triglops beani	×	×	×	×	
scepticus			×	×	
Sternias xenostethus				×	
Prionistius macellus			×	×	
Elanura forficata			×	×	
Melletes papilio				×	
Hemilepidotus jordani		×	×	×	
hemilepidotus	×	×	×	×	
COTTIDÆ—Continued.					
Enophrys bison	×	×	×		
claviger				×	
Ceratocottus diceraus		×	×	×	
Cottus asper	×	×			
gulosus	×	×			
cognatus				×	×
aleuticus		×	×	×	
chamberlaini		×			
Myoxocephalus polyacanthocephalus	×	×	×	×	×
jaok		×	×	×	×
verrucosus			×	×	×
axillaris			×	×	×
stelleri				×	×
niger			×	×	
Megalocottus platycephalus				×	
laticeps				×	×
Zesticelus profundorum				×	
Thecopterus aleuticus				×	
Dasycottus setiger	×	×	×	×	
Malacocottus zonurus		×	×	×	
Porocottus sellaris				×	
quadrifilis				×	
bradfordi			×		
Oncocottus quadricornis				×	×
hexacornis			×	×	×
Gymnocanthus pistilliger				×	×
galeatus		×	×	×	×
Leptocottus armatus	×	×	×		
Oligocottus maculosus	×	×	×		
Sigmistes caulias			×		
Blennicottus acuticeps			×	×	
globiceps		×	×	×	
embryum			×		
clarki				×	
Histiocottus bilobus		×	×		
Blepsias cirrhosus	×	×	×	×	
Nautiscus pribilovius			×	×	
Nautichthys oculofasciatus	×				
Ulca marmorata		×	×	×	
Hemitripterus cavifrons			×	×	
Synchirus gilli	×				
Psychrolutes paradoxus	×	×	×	×	
Gilbertidia sigolutes		×			
RHAMPHOCOTTIDÆ:					
Rhamphocottus richardsoni	×		×		
AGONIDÆ:					
Hypsagonus quadricornis	×		×	×	
Occa dodecaedron				×	
Pallasina barbata	×	×	×	×	
aix			×		
Podothecus acipenserinus	×	×	×	×	×
Averruncus emmelane	×				
Sarritor frenatus			×	×	
leptorhynchus			×	×	
Bathyagonus nigripinnis	×	×	×	×	
Xenochirus pentacanthus	×	×	×		
alascanus			×	×	
latifrons	×				
Odontopyxis trispinosus	×	×			
Aspidophoroides guntheri				×	
bartoni			×	×	
inermis	×		×	×	
CYCLOPTERIDÆ:					
Eumicrotremus orbis	×		×	×	
Lethrotremus muticus			×	×	
Cyclopteroides gyrinops			×	×	
Cyclopterichthys ventricosus			×	×	
LIPARIDIDÆ:					
Neoliparis rutteri			×		
collyodon		×	×	×	
Liparis cyclopus			×	×	
fucensis	×	×	×		
agassizii			×	×	×
herschelinus					×
cyclostigma				×	
pulchellus		×	×	×	
Crystallichthys mirabilis				×	
Careproctus simus				×	
colletti			×		
phasma				×	

Family and species.	Puget Sd. and Br. Col. reg.	SE. Alaska.	Cent. Alaska.	Bering Sea.	Arctic Ocean.
LIPARIDIDÆ—Continued.					
Careproctus spectrum			×		
ostentum				×	
ectenes				×	
Prognurus cypselurus				×	
Gyrinichthys minytremus				×	
Paraliparis holomelas	×	×	×	×	
cephalus				×	
ulochir				×	
Rhinoliparis barbulifer				×	
BATHYMASTERIDÆ:					
Bathymaster signatus		×	×	×	
Ronquilus jordani	×	×	×	×	
TRICHODONTIDÆ:					
Trichodon trichodon		×	×	×	
Arctoscopus japonicus			×		
BATRACHOIDIDÆ:					
Porichthys notatus	×				
GOBIESOCIDÆ:					
Caularchus mæandricus	×				
BLENNIIDÆ:					
Bryostemma polyactocephalus	×	×	×	×	
Apodichthys flavidus	×				
Pholis dolichogaster			×	×	
fasciatus			×	×	
gilli				×	
ornatus	×	×	×	×	
Anoplarchus atropurpureus	×	×	×	×	
Xiphistes chirus			×	×	
Xiphidion mucosum	×	×			
rupestre		×			
Opisthocentrus ocellatus				×	
Leptoclinus maculatus			×	×	
Poroclinus rothrocki			×	×	
Lumpenus medius		×	×		
anguillaris	×	×	×	×	
mackayi				×	
fabricii				×	
longirostris		×			
Stichæus punctatus		×		×	×
CRYPTACANTHODIDÆ:					
Delolepis virgatus	×	×	×	×	
Lyconectes aleutensis				×	
ANARHICHADIDÆ:					
Anarhichas lepturus				×	
PTILICHTHYIDÆ:					
Ptilichthys goodei		×	×	×	
ZOARCIDÆ:					
Lyciscus crotalinus			×		
Lycodopsis pacificus	×	×	×		
Lycodes concolor				×	
digitatus				×	
palearis		×	×	×	
jordani	×	×			
ZOARCIDÆ—Continued.					
Lycodes brevipes	×	×	×	×	
Lycodalepis turneri				×	×
Furcimanus diaptera	×	×		×	
Bothrocara pusilla		×	×	×	
mollis				×	
Gymnelis viridis			×	×	×
stigma				×	
Melanostigma pammelas		×			
LYCODAPODIDÆ:					
Lycodapus fierasfer		×		×	
parviceps				×	
extensus				×	
MERLUCCIDÆ:					
Merluccius productus	×				
GADIDÆ:					
Boreogadus saida				×	×
Theragra chalcogramma	×	×	×	×	
fucensis		×			
Eleginus navaga	×	×	×	×	
Microgadus proximus	×	×	×	×	
Gadus macrocephalus	×	×	×	×	
Antimora microlepis				×	
Lota maculosa				×	×
MACROURIDÆ:					
Albatrossia pectoralis				×	
Bogoslovius clarki				×	
firmisquamis				×	
Chalinura serrula		×			
Macrourus acrolepis				×	
cinereus		×		×	
PLEURONECTIDÆ:					
Atheresthes stomias	×	×	×	×	
Hippoglossus hippoglossus		×	×	×	
Lyopsetta exilis	×	×			
Eopsetta jordani	×		×	×	
Hippoglossoides elassodon	×	×	×	×	
Psettichthys melanostictus	×	×			
Parophrys vetulus	×	×	×		
Inopsetta ischyra	×		×		
Isopsetta isolepis	×		×		
Lepidopsetta bilineata	×	×	×	×	
Limanda aspera		×	×	×	
proboscidea				×	
Pleuronectes quadrituberculatus			×	×	×
Liopsetta glacialis			×	×	×
Platichthys stellatus	×	×	×	×	×
Microstomus pacificus	×	×	×	×	
Glyptocephalus zachirus	×	×	×	×	
Citharichthys sordidus			×	×	
stigmæus	×				
Total	119	134	149	189	36

Family I. HEPTATREMIDÆ. The Borers, or Hagfishes.

1. **Polistotrema deani** Evermann & Goldsborough, new species.

Head to first gill-opening 6.5 in total length; depth 13.6; tail 7; branchial distance 7.3; gill-openings 11 or 12; teeth 11 + 11 and 10 + 10; base of tongue under third gill-opening.

Body long and slender, little compressed; head somewhat depressed; nostril broad, slit-like, terminal; mouth a longitudinal slit with wrinkled edges; 8 barbels, 4 above and 4 below; apparently no anterior rudimentary gill-slits. Fin-fold well pronounced on ventral surface of body, gradually disappearing in front of middle of length; caudal rounded, showing ray-like marks.

Color purplish-blue or that of the Santa Clara prune, becoming blacker in alcohol, and uniform over the whole body; ventral fold or anal fin not bordered by white; no white border about gill-openings.

This species differs from *Polistotrema stouti* in a number of important respects, chief of which are the much shorter head (6.5 instead of 4.5 in body), the longer tail (7 instead of 8), the more numerous teeth, and the color. In *P. stouti* the ground color of fresh specimens[a] was brown plus a little pink, which changes to a bluish tint in preserved specimens; ventral fold or anal fin bordered by white, which often encircles the caudal fin; gill-openings bordered by white ring; old examples often mottled or blotched about the head with white; a few specimens had in addition 1 or 2 black blotches on the side of the body.

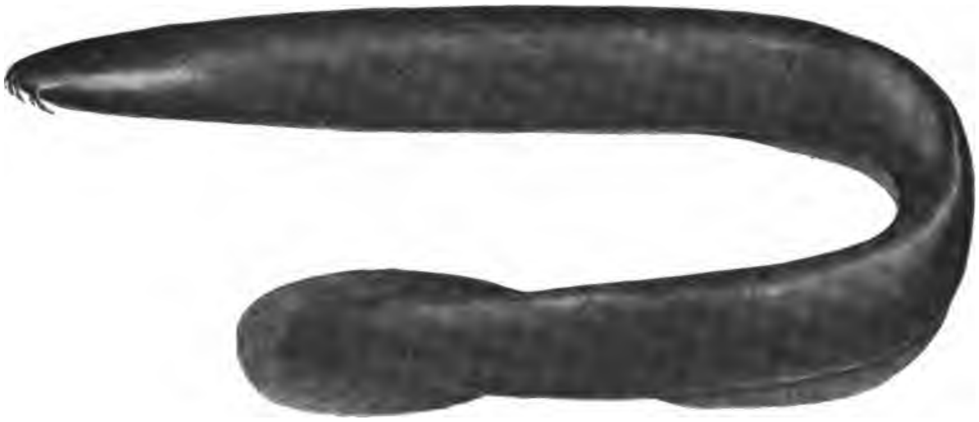

FIG. 1.—Polistotrema deani Evermann & Goldsborough, new species. Type.

In the following table are given certain comparative measurements of 97 examples of *P. stouti*,[a] and corresponding measurements of our 4 specimens of *P. deani*. All measurements, etc., were taken from the right side of fresh hags that had just died. The specimens were laid flat on a board, but none was stretched. In two of the specimens of *P. deani* the left side was used, as being more satisfactory. All measurements are in millimeters, from which proportional measurements can be readily computed.

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[a] From Monterey Bay and examined for us by Mr. William F. Allen, at the Hopkins Seaside Laboratory.

COMPARATIVE MEASUREMENTS OF POLISTOTREMA STOUTI AND P. DEANI.

Polistotrema stouti.

No. of specimen.	Tip of snout to tip of tail.[a]	Tip of snout to center of first gill opening.	Center of first gill-opening to center of last.	Number of branchial openings.	No. of specimen.	Tip of snout to tip of tail.[a]	Tip of snout to center of first gill opening.	Center of first gill-opening to center of last.	Number of branchial openings.
	mm.	*mm.*	*mm.*	*mm.*		*mm.*	*mm.*	*mm.*	*mm.*
1	550	130	64	12	50	430	106	54	11
2	415	115	60	12	51	481	124	60	12
3	402	97	53	12	52	475	115	63	12
4	555	127	73	12	53	464	114	60	12
5	582	135	73	13	54	503	122	64	12
6	540	122	68	12	55	426	94	60	12
7	490	111	63	12	56	442	104	58	11
8	482	112	68	12	57	490	118	61	12
9	512	116	70	12	58	355	89	42	11
10	475	111	65	12	59	480	125	57	11
11	453	113	61	12	60	472	110	65	12
12	415	92	57	13	61	386	92	53	11
13	511	114	72	12	62	390	93	48	12
14	412	91	56	11	63	410	111	57	12
15	477	112	67	12	64	510	122	68	12
16	494	116	65	12	65	503	120	72	12
17	503	118	65	11	66	485	113	60	12
18	468	116	60	12	67	412	105	51	11
19	512	130	61	11	68	486	116	70	13
20	458	112	53	11	69	465	114	68	12
21	460	109	63	12	70	460	112	64	12
22	488	117	64	12	71	467	114	61	12
23	482	115	63	12	72	440	110	66	12
24	473	118	59	12	73	512	125	65	12
25	470	118	63	12	74	378	95	46	12
26	490	123	64	12	75	438	103	66	12
27	422	117	53	11	76	460	127	57	12
28	470	118	61	11	77	436	110	53	11
29	410	97	53	12	78	370	90	48	11
30	473	117	63	11	79	383	95	50	12
31	480	120	54	11	80	438	110	59	11
32	470	110	62	11	81	550	131	74	12
33	403	91	49	12	82	473	109	66	12
34	462	110	58	13	83	478	114	63	11
35	440	115	58	12	84	427	100	57	11
36	433	112	57	13	85	492	119	72	12
37	458	111	61	12	86	430	105	58	12
38	485	122	65	12	87	486	116	67	11
39	482	120	58	12	88	545	125	74	11
40	463	116	55	12	89	510	116	66	12
41	492	120	68	12	90	488	123	69	12
42	510	129	63	11	91	476	112	60	11
43	473	109	60	12	92	482	118	64	12
44	458	108	55	12	93	440	109	54	11
45	519	124	62	12	94	444	112	68	12
46	473	116	63	12	95	413	98	56	12
47	582	137	71	11	96	412	98	57	12
48	480	110	75	12	97	463	120	68	12
49	434	108	58	11					

Polistotrema deani.

2866	485	83	79	11 left.	2877	640	97	84	11 right.
2867	520	86	73	11 left.	2880	470	87	67	11 right.

[a] Not including tentacles.

Polistotrema deani is known from 4 specimens, all in rather poor condition: Two, no. 2866 and 2867, 19 and 21 inches long, respectively, dredged by the *Albatross* in 1903, in 130 to 193 fathoms at station 4235, in Spacious Bay, Cleveland Peninsula, Alaska; and two, no. 2877 and 2880, 24.5 and 18.5 inches long, dredged on same date in 229 to 231 fathoms at station 4238, in Behm Canal off Nose Point.

Type no. 57820 U. S. National Museum (field no. 2880), Albatross station 4238 in Behm Canal off Nose Point, in 229 to 231 fathoms. The three other specimens are cotypes, of which two are deposited in the U. S. National Museum and one in the Museum of Stanford University.

We take great pleasure in naming this interesting species for Prof. Bashford Dean, of Columbia University, in recognition of his excellent work "On the Embryology of *Bdellostoma stouti*."

Family 2. PETROMYZONIDÆ. The Lampreys.

2. **Entosphenus tridentatus** (Gairdner).

Four specimens 16 to 18 inches long, collected by Mr. Chamberlain in Naha River near Loring, June 23, 1903, and a 6-inch specimen seined by him in McDonald Lake, August 24, 1905. Mr. Chamberlain reports that lampreys were quite abundant June 22 at the foot of Dorr Falls in Naha stream. More than 50 were observed attached to the rocks. They were first noticed June 20 and all had disappeared in a week or ten days. Five males and 5 females were examined. Of the latter all but one appeared to have done spawning, and it is believed they were there for spawning purposes.

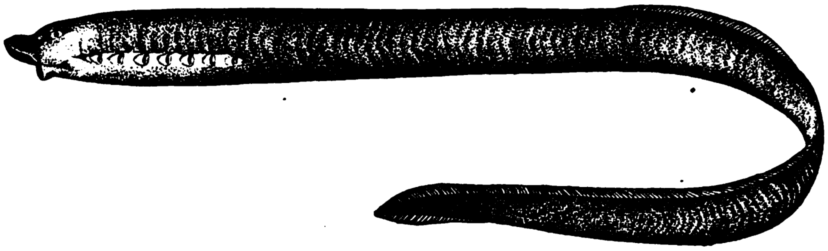

FIG. 2.—Entosphenus tridentatus (Gairdner).

At the Yes Bay hatchery a number of young were caught in the flume which brings water to the hatchery from a point on the creek below the falls. It is believed that the lamprey spawns among the rocks at the foot of that falls.

This species was recorded at Unalaska, by Gilbert in 1895.

3. **Lampetra aurea** (Bean). *Lamprey Eel.*

This species, originally described from Anvik, Yukon River, and recorded from Fort Yukon by Bean in 1882 as *Ammocœtus aureus*, was not seen by us. Recorded from Mission, Yukon River (Nelson 1887), as *Ammocœtus aureus*.

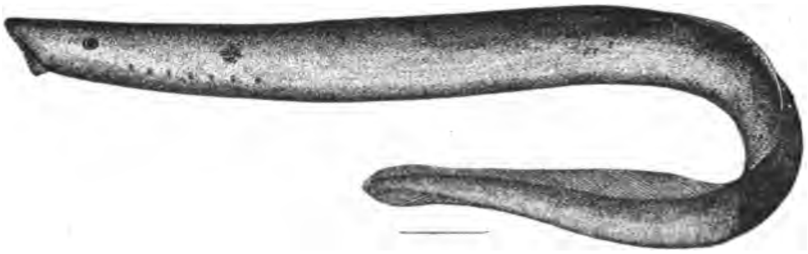

FIG. 3.—Lampetra aurea (Bean).

Mr. V. L. Derby, formerly a school-teacher at St. Michael and Point Barrow, in a letter dated January 19, 1907, furnishes the following interesting note on this species:

> In the spring—I believe during the month of April—the eels start up the river in one large school, presumably to spawn. I am not enlightened upon this point, but suspect they live in the salt water through the greater portion of the year and as spawning season draws near they enter the fresh water streams. I am in the dark whether they are found in other streams in Alaska besides the Yukon.
>
> As the time approaches for the arrival of the "snaky" forms, the Indians keep close watch for the first arrivals. Remember that the great river is covered with ice from 4 to 5 feet in thickness at this time of the year, and it is no small task for the young boys to keep a number of large holes open and occasionally dipping with their large dip nets. These nets are also used by the natives to catch salmon during the running season. Saw several Indians in their kyaks using their dip nets, but during the short time I was in sight of them aboard the United States transport did not have the pleasure of seeing a fish caught.
>
> When the eels are reported as having come, the whole village—men, women, and children—go out quickly and gather in a harvest of these fish while the school is passing, and when the rear guard has

safely eluded the last net an Indian boy, swift on foot, is sent to apprise the villagers above of the coming eels, and so on, all the way up the river.

In the "cut" there looks to be some 15 or 20 bushels of frozen eels. I understand these eels are exceedingly oily, and if the oil were clarified would make a good oil for painting purposes.

The Indians catch these eels mostly for dog food, but do eat them only when there is a scarcity of other foods, as they are much stronger flavored than the eels we have in the fresh water streams in the States.

Family 3. SQUALIDÆ. The Dogfishes.

4. **Squalus sucklii** (Girard). *Dogfish.*

Specimens were secured in gill nets or seine at Nanaimo, Fort Rupert, Union Bay, and Diamond Point; others were taken on hook and line at Loring, Cleveland Passage, and a single specimen (field no. 3018), 29 inches long, was taken over the rail of the ship at Klawock. A female taken on hook and line in Cleveland Passage was 44 inches long, weighed 17 pounds, and contained 14 very active young. Each was about 7.5 inches long, and the yolk sac was very large. Another specimen was taken on hook and line at Shakan and one at Port McArthur.

Those taken at Nanaimo were secured June 20 in a 5½-inch mesh gill net set at the surface on the south side of the outer harbor. They were four in number, each about 3 feet long, all females with 4, 6, 9, and 9 embryos, respectively. The embryos in those having 9 were each about 9 inches long, those in the other two were only about 1.5 inches long. Spots on the larger embryos were very plain; no pigment developed in the smaller ones, except in the eyes.

The dogfish is apparently common throughout Southeast Alaska, where, as elsewhere, it is regarded with disfavor. At Loring considerable numbers are caught for the oil that is tried out of the liver. They are taken by means of a gaff hook as they come about the cannery to feed upon the offal.

This species has been recorded (as *Squalus acanthias*) by Bean (1882) from Sitka; Port Althorp; Marmot Island; and Red Bay.

Family 4. SOMNIOSIDÆ. The Sleeper Sharks.

5. **Somniosus microcephalus** (Bloch). *Sleeper Shark.*

Two dead examples were seen July 13, 1903, on a mud flat at the Point Highfield cannery, where they had been left by the tide. One lying near shore was a female 11 feet long. Skin covered with short, stiff, hair-like prickles. Examined for its fœtuses, but none found. On the evening of July 14, at Sunny Bay, Taku Inlet, 2 examples were caught over the rail of the steamer. One took the bait, the other was accidentally hooked in the tail. The latter was a female and gave the following measurements:

Total length 8 feet 2 inches; length of snout to middle of eye 10 inches, to first gill opening 20 inches, to last gill opening 25 inches, to base of pectoral 28 inches, to origin of first dorsal 50 inches, to spiracle 13.5 inches, diameter of eye 1.5 inches; distance from front of first dorsal to second dorsal 24 inches, from front of second dorsal to base of caudal 16 inches; length of upper caudal lobe 17.5 inches, lower caudal lobe 13 inches; length of gill slit 3.75 inches; posterior height of second dorsal 6 inches, base 4.5 inches; posterior height of first dorsal 5 inches, base 5 inches; length of pectoral 11 inches, base 13.5 inches; height of ventral 5 inches, base 5.5 inches; girth at base of pectoral 51 inches; greatest girth at upper base of pectoral 52 inches; greatest girth of tail 16 inches, least girth 12.25 inches. Total weight 381 pounds, liver 48 pounds. Ovaries very immature; gall 24 ounces. Axil to axil over back 28 inches. Color sooty black, a little mottled.

Also recorded from Hassler Harbor (Bean 1884) and St. Michael (Turner 1886). **Mr. A. B. Alexander** informs us that the *Albatross* has taken examples on trawls at various places in Alaska.

Family 5. SQUATINIDÆ. The Angel Sharks.

6. **Squatina squatina** (Linnæus).

One specimen, a female 14 inches long. The locality label has been lost.

Family 6. RAJIDÆ. The Rays and Skates.

7. **Raja binoculata** Girard. *Big California Skate.*

Common. The collection contains the following specimens: No. 2896, a male 10 inches long, from station 4248, in Eastern Passage near Wrangell; no. 2748, a small male seined at Klawock; no. 2837; no. 2839, a female; no. 2841, a female 21 inches long, from Puget Sound near Port Townsend; no. 2871, a female; six specimens 6 to 13 inches long collected in Puget Sound by Mr. Todd; one (no. 1272) 15.5 inches long dredged by the *Albatross* August 28, 1891, at station 3450, off Washington. Other specimens were dredged at stations 4211, 4214, 4219, 4233, 4192, and in Kilisut Harbor; examples were seen also at Port Townsend, Nanaimo, Karta Bay, Yes Bay, and Dundas Bay. Two very large examples were examined at a salmon trap. Both were females, on which the following notes were made:

	First example.	Second example.
Total length .... inches..	56.0	51.00
Length of disk .... do....	36.5	33.25
Width of disk .... do....	39.5	35.00
Tip of snout to angle of pectoral .... do....	30.0	24.00
Tip of pectoral to base of tail .... do....	24.5	23.00
Weight .... pounds..	48.0	32.00

Mr. Bell, superintendent of the Dundas Bay cannery, says rays are often taken in the salmon traps, some much larger than these.

At Kilisut Harbor, July 1, two egg capsules were dredged. One was empty, but the other contained 4 eggs, each about the size of a hen's egg. The attached embryos were long (each about 3 inches), slender and very squirmy.

No. 2896 is described as follows: Length of disk 1.4 in width; tail 1.3 in length of disk; anterior edge of pectoral scarcely less than length of disk, one-half greater than posterior edge; snout 3 in length of disk; interorbital width 2.5 in snout; width of mouth equalling interorbital width; disk much broader than long; anterior margin of pectoral nearly straight, scarcely or not at all convex, the 2 margins forming an angle of 95 to 98 degrees; tip of snout not produced, nor differentiated from general outline; posterior margin of pectoral gently convex, forming an angle of about 90 degrees with the anterior margin. Three sharp spines about the eye, 2 in front, the third above and posterior; one strong spine on median line of back, midway between nostrils and humeral region; tail with a series of 14 stout prickles beginning at base and extending to first dorsal fin; one small spine between the 2 dorsals; upper part otherwise entirely smooth and without prickles of any kind; under parts entirely smooth.

Color light brown; a large black spot equal to twice longest diameter of eye at base of pectoral, surrounded by a broad ring of reddish brown, which in turn is surrounded by a nearly equally broad black ring; the total diameter of the ocellated spot slightly exceeding the inter-spiracle width; an obscure brownish spot behind the large ocellated spot slightly greater than eye in diameter; back profusely covered with small irregularly placed paler spots, those on posterior margin of pectoral oblong.

From typical *R. binoculata* this specimen differs in the less projecting snout, the coloration, and the spines. The large spot at the base of the pectoral is that of *R. stellulata*, but the prickles are less evident.

An examination of our material shows that the males differ from the females in having the snout blunter and less produced and the pectoral ocellus much larger and more distinct. It is also evident that the prickles become more numerous with age. As these variations cover all the differences in characters assigned to the 3 nominal species *R. binoculata* Girard, *R. rhina* Jordan & Gilbert, and *R. stellulata* Jordan & Gilbert, we are compelled to regard the three as one species. We have compared our specimens with the types of *R. rhina* and *R. stellulata*.

Recorded by Bean (1882), as *Raja binoculata*, from the following localities: Sitka; Port Althorp; St. Paul, Kodiak Island; and Wrangell. By Gilbert (1895) as *Raja stellulata*, from Unimak Pass, Bristol Bay, and along the northern shores of Unalaska Island at stations 3217, 3255, 3258, 3310, and 3312.

Raja binoculata Girard, Proc. Ac. Nat. Sci. Phila. 1854, 196, **San Francisco.**
Raja cooperi Girard, Pac. R. R. Surv., 372, 1858, **Shoalwater Bay, Washington.**
Raja stellulata Jordan & Gilbert, Proc. U. S. Nat. Mus. 1880, 133, **Monterey.**
Raja rhina Jordan & Gilbert, Proc. U. S. Nat. Mus. 1880, 251, **Monterey and San Francisco.**

8. **Raja parmifera** Bean.

One specimen (no. 2904) 7 inches long, and 4 eggs, dredged at station 4252, in Frederick Sound; another (no. 3001) 23 inches long, at station 4291, in Shelikof Strait; one (no. 3005) 21 inches long, at station 4295, in Shelikof Strait; two from station 4280, in Chignik Bay; and two from Alitak Bay. The latter were both males, and furnished the following notes: First example, length of disk 21 inches; width 24; length of tail 20; snout to angle of pectoral 18; tip of snout to eye 7.5; weight 14 pounds. Second example, length of disk 28 inches; width 31; tail 24; snout to angle of pectoral 22; tip of snout to eye 9.5; weight 25 pounds. Thirty to 33 spines on median line of back and tail; no marginal row of larger spines on tail in female; spines on back more numerous and smaller in female; male with two large humeral spines, female with one; supraoccipital crest more developed in the male.

Originally described by Bean (1882) from Iliuliuk, Unalaska. Gilbert (1895) records it from Albatross stations 3252, 3259, 3267, 3270, 3272, 3281, 3282, 3292, 3293, 3310, and 3313, all in Bristol Bay.

9. **Raja aleutica** Gilbert.

No. 1775 (1726), a specimen 33 inches long, collected at station 3602.

Dorsal and caudal fins covered with small prickles; 4 large spines in shoulder region on median line; after a slight interspace 32 additional spines on median line of back and tail, 2 of the latter being between the dorsals. The spines are large anteriorly, becoming smaller to the root of the tail, thence larger, as large as the anterior ones for half length of tail, whence they grow gradually smaller to tip of tail. Teeth quite sharp, conical; lateral edges of upper lip fringed; back with small prickles everywhere, except an area below and behind eyes to below shoulder region, and the edges of pectoral laterally and posteriorly; a row of pores, with short tubes, on each side and just below the first median spine, these diverging toward each eye, running half the distance from spine to eye, the area about them being free from prickles; a similar row of pores around the entire margin of the disk and also on each side of the nasal cartilage; lateral and posterior angles of disk broadly rounded, margin between these angles gently rounded.

Originally described by Gilbert (1895) from station 3257, north of Sannak Pass, Aleutian Islands.

10. **Raja trachura** Gilbert.

Recorded by Gilbert (1895) from station 3338, south of the Shumagin Islands. Not seen by us.

11. **Raja abyssicola** Gilbert.

Originally described from Albatross station 3342, off Queen Charlotte Island, in 1,588 fathoms.

Family 7. CHIMÆRIDÆ. The Chimæras.

12. **Hydrolagus colliei** (Lay & Bennett). *Ratfish.*

Common. Specimens were caught in gillnet at Nanaimo; one was seined at Port Alexander, and others were dredged at stations 4191, 4197, 4201, 4215, 4216, 4218, 4219, 4221, 4223, and 4246. Seven specimens examined are 4.5 to 12 inches long. We have examined another example (no. 2442) 13.5 inches long, dredged by the Albatross April 30, 1901, at station 3790, off Tatoosh Island Light, in 122 fathoms. In this specimen the caudal is produced into a decided filament.

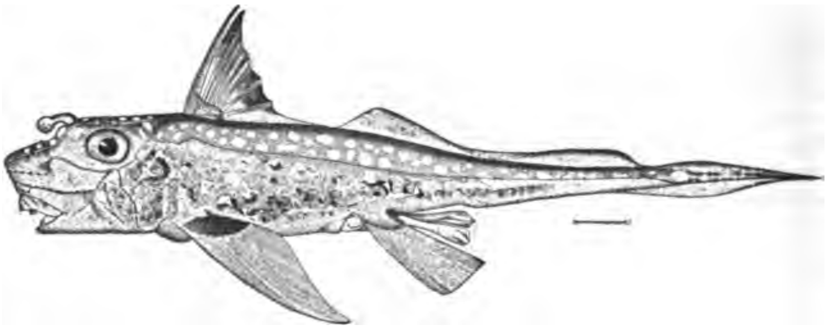

FIG. 4.—Hydrolagus colliei (Lay & Bennett).

Recorded from Alaska and Alexander Archipelago as *Chimæra colliei* (Bean 1882).

Family 8. ACIPENSERIDÆ. The Sturgeons.

13. **Acipenser medirostris** Ayres. *Green Sturgeon.*

According to Mr. J. F. Williams, of Chignik Bay, 2 green sturgeon were caught some years ago (1897) in the Copper River. Each was about 4 feet long. We were told of one seen in the Columbia River which weighed 900 pounds.

It is said that years ago San Francisco restaurants served sturgeon steaks as sea bass or sole.

Family 9. CATOSTOMIDÆ. The Suckers.

14. **Catostomus catostomus** (Forster). *Long-nosed Sucker; Northern Sucker.*

Very abundant in Watson River, near Caribou, Yukon Territory, where 76 specimens 4 to 10.5 inches long were seined July 18 and 19.

Head 4.2; depth 5.5; eye 6; snout 2.2; dorsal 10; anal 7; scales 20-110 to 120-15 to 17, 60 to 65 in front of dorsal; length of pectoral 1.25 in head; ventral 1.6; height of dorsal 1.5. Color in life, mottled olive; belly somewhat silvery; head brassy; fins all dull orange, the dorsal darker at tip.

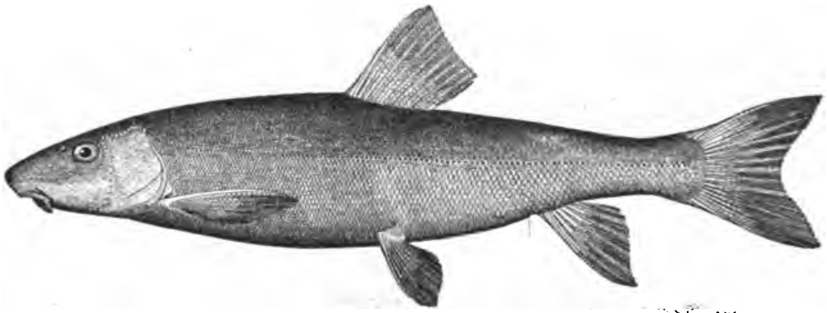

FIG. 5.—Catostomus catostomus (Forster).

Compared with specimens from Clear Creek, near Clearmont, Wyo., the Caribou specimens have considerably smaller scales (the Wyoming specimens having only 90 to 100 in course of lateral line), and more pointed head, with longer snout.

This species has a wider distribution than any other member of the family. It was described originally from the Hudson Bay region, and has since been recorded from various localities from New England westward to the headwaters of the Missouri and the Columbia and northward to Alaska. It is doubtless abundant in all suitable waters from the Hudson Bay region west and northwestward. At Great Slave Lake, on the Yukon, and elsewhere, it is a food fish of considerable importance, especially to the Indians. An examination of numerous specimens in the present collection indicates that the spawning season at Caribou is entirely over by July 19.

Recorded from Nulato, Yukon River, as *Catostomus longirostris* (Bean 1882). Upper Kobuk River (Townsend 1887). Nulato and Andreafski, Yukon River, and streams flowing into Kotzebue Sound (Turner 1886).

Cyprinus castostomus Forster, Philos. Trans. for 1773, 155, streams about Hudson Bay.
Catostomus longirostrum Le Sueur, Jour. Ac. Nat. Sci. Phila. 1817, 102, Vermont.
Catostomus hudsonius Le Sueur, Jour. Ac. Nat. Sci. Phila. 1817, 107, Vermont. Günther, Cat., VII, 13, 1868.
Catostomus forsterianus Richardson, Franklin's Journal 1823, 720, Lake Huron and Great Slave Lake.
Catostomus aurora Agassiz, Lake Superior, 360, figs. 3 and 4, 1850, The Pic, Lake Superior.
Catostomus longirostris, Jordan, Bull. U. S. Nat. Mus., XII, 175, 1878 (Nulato, Yukon River; St. Michael's, Alaska).
Catostomus nanomyzon Mather, Twelfth Rept. N. Y. Fish Comm. 1884, 36, Big Moose Lake, Northern New York.

Family 10. SYNAPHOBRANCHIDÆ.

15. **Histiobranchus bathybius** (Günther).

One specimen reported by Dr. Gilbert from Bering Sea in 1895 at Albatross station, 3308.

Family 11. NEMICHTHYIDÆ. The Snipe Eels.

16. **Avocettina gilli** (Bean).

Originally described from Albatross station 2859, east of Prince of Wales Island, in 1,569 fathoms. Only the type known.

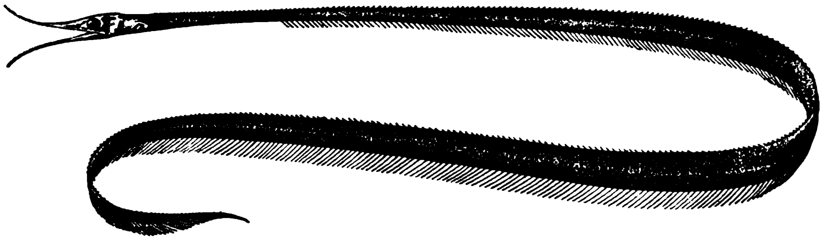

FIG. 6.—Avocettina gilli (Bean).

Family 12. CLUPEIDÆ. The Herrings.

17. **Clupea pallasii** Cuvier & Valenciennes. *California Herring.*

The collection contains 64 specimens 2 to 12.5 inches long, from Loring, Marrowstone Point, Kilisut Harbor, Admiralty Head, Pablof Harbor, Litnik Bay, Cleveland Passage, Port Alexander, and Karluk; Sitka, collected by Mr. Luttrell in September, 1893; Unalaska, July 2, 1900; Killisnoo, August 21, 1900; Pyramid Harbor, August 23, 1900; Utsalady, Washington, October 2, 1895; Cordova Bay, Prince of Wales Island, in 1897; Litnik Bay, August 15, 1900, and Petropaulski, June 20, 1900.

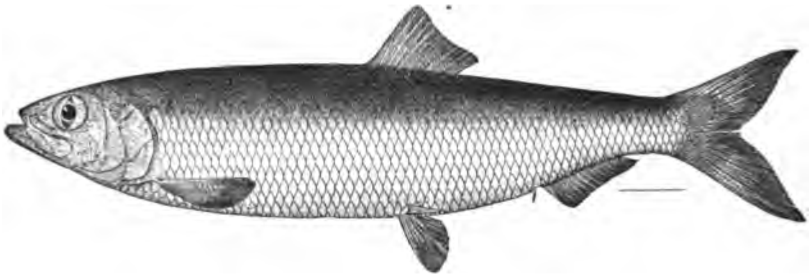

FIG. 7.—Clupea pallasii Cuvier & Valenciennes.

In the seining operations this species was found in abundance at Port Alexander, Kilisut Harbor, Marrowstone Point (the examples all young), Uyak Bay (adults), Litnik Bay (adults), and Cleveland Passage (many young, 5 inches long).

It is said to be abundant in Chilkoot Inlet in April and May. Seventy-one examples taken at Uyak Bay weighed 47.75 pounds, the average weight being therefore 10.76 ounces. The average length was 11.67 inches. The individual weights and lengths are given in the following table:

Individual Lengths and Weights of Seventy-one Pacific Herring (Clupea pallasii), Taken at Uyak Bay, Alaska, August 4, 1903.

Specimen.	Length.	Weight.	Specimen.	Length.	Weight.	Specimen.	Length.	Weight.
	Inches.	*Ounces.*		*Inches.*	*Ounces.*		*Inches.*	*Ounces.*
1	13.5	12.0	25	13.0	12.5	49	12.0	9.0
2	13.0	12.0	26	12.0	9.5	50	12.0	9.0
3	13.0	12.0	27	12.5	11.0	51	12.0	8.5
4	12.0	10.5	28	13.0	13.0	52	12.5	10.5
5	12.0	10.5	29	13.5	14.0	53	11.0	7.0
6	12.5	12.5	30	13.5	13.5	54	12.5	12.0
7	13.5	12.5	31	14.0	14.0	55	12.0	9.0
8	10.5	5.5	32	14.0	14.0	56	13.5	13.0
9	14.0	13.5	33	13.5	12.0	57	11.0	7.0
10	12.5	12.5	34	13.5	12.5	58	13.0	11.5
11	13.0	11.5	35	12.5	10.0	59	12.0	8.5
12	13.0	12.5	36	12.5	10.0	60	13.5	12.5
13	13.5	13.5	37	13.5	12.0	61	12.0	9.5
14	13.5	13.5	38	13.5	12.0	62	12.5	9.5
15	13.5	12.5	39	13.5	13.5	63	11.0	7.5
16	13.5	14.5	40	12.5	10.0	64	12.0	9.0
17	13.0	10.5	41	14.0	13.5	65	12.0	8.0
18	13.0	11.5	42	13.0	10.5	66	13.0	13.5
19	13.0	11.5	43	12.0	9.0	67	12.5	8.5
20	13.0	12.5	44	13.0	11.5	68	12.0	8.5
21	13.5	13.0	45	11.5	10.0	69	10.0	5.0
22	12.5	10.5	46	12.5	11.0	70	10.0	6.0
23	13.5	15.0	47	12.5	10.5			
24	11.5	8.0	48	11.5	8.0			

The herring is now a fish of considerable and growing importance in Southeast Alaska. It is salted to some extent at certain of the salmon canneries, and when so prepared is an excellent article of food. For a number of years great quantities have been used for oil and fertilizer at Killisnoo. Recently it has come to be in great demand as bait in the halibut fisheries.

According to Mr. Cobb[a], this fish is said to spawn in southeast Alaska in May to July. The grounds are widely distributed from Howkan to Skagway and through Icy Straits to Cross Sound. After spawning the fish are said to school out in the deeper water of Frederick Sound and Stephens Passage, and later reenter the bays to feed. During July and August they are filled with "red feed," and are then very difficult to cure. In September and October their food seems to change and they are then in prime condition. The runs are usually composed of mixed sizes, although in early summer the sizes are said to be uniformly small in some places.

The herring is one of the chief articles of food of the king salmon in the winter and spring in certain parts of Alaska, particularly about Killisnoo, Chilkoot Inlet, and Ketchikan. This was observed during an unusual run of king slamon, which began about the middle of January, 1905, and continued until May 18. There is usually a large run of herring in Chilkoot Inlet early in the spring.

Recorded by Bean (1884) from Sitka; Old Sitka; Port Althorp; Port Mulgrave; Chugachik Bay, Cook Inlet; Iliuliuk, Unalaska; St. Michael; and Port Clarence; and (1882) Wrangell. Unalaska and Herendeen Bay (Gilbert 1895). St. Michael; Unalaska Harbor, and Norton Sound (Nelson 1887). Port Clarence (Scofield 1899).

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[a] Fisheries of Alaska in 1906, Bureau of Fisheries Document 618, p. 52, 1907.

18. **Alosa sapidissima** (Wilson). *Atlantic Shad.*

The shad has extended its range far northward. The cannery at Fairhaven took one about July 1, 1903, and the fishermen at Birch Point got about 3,000 in one day. The species has been reported from Stikine River and in 1904 it was taken at Kasilof, on Cook Inlet.

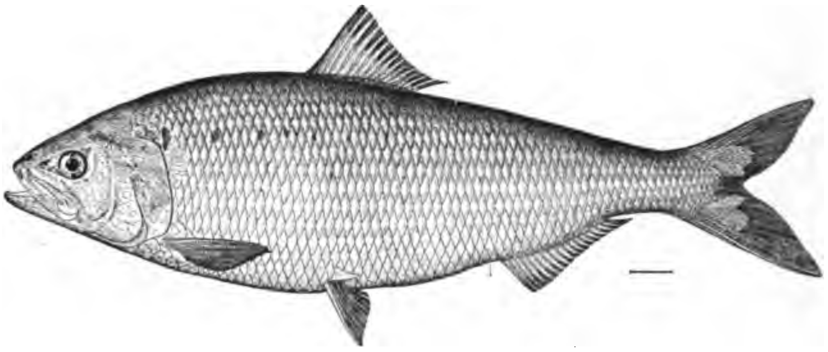


FIG. 8.—Alosa sapidissima (Wilson).

Family 13. SALMONIDÆ. The Salmons, Trouts, and Whitefishes.

19. **Coregonus kennicotti** Milner. *Kennicott's Whitefish.*

Two specimens, 6 and 6.25 inches long, were secured at Lake Bennett.

Scales 13–76 to 82–8; gillrakers 5+14 (right), 7+12 (left), rather long and slender, somewhat blunt tipped, but firmer than in *C. quadrilateralis,* their length about diameter of pupil.

This species may be readily distinguished from the round whitefish found in the same waters by the somewhat larger mouth, longer and more numerous gillrakers, larger and much more caducous scales, and more elevated back.

This species of whitefish is probably common in Lake Bennett, Tagish Arm, Lake Atlin, and other headwaters of the Yukon. It has been previously recorded from Alaskan localities as follows: Yukon River at Nulato and St. Michael (Bean 1882), Middle Kobuk River (Townsend 1887), rivers about Point Barrow (Murdoch 1885), St. Michael (Nelson 1887), and Barter Island near the mouth of the Mackenzie River (Scofield 1899).

20. **Coregonus quadrilateralis** Richardson. *Round Whitefish.*

Twenty-five specimens, 3.75 to 11.5 inches long, seined in Lake Bennett, and 4 at Caribou Crossing.

Scales 10–95 to 100–8; gillrakers very short and weak, about 7+10.

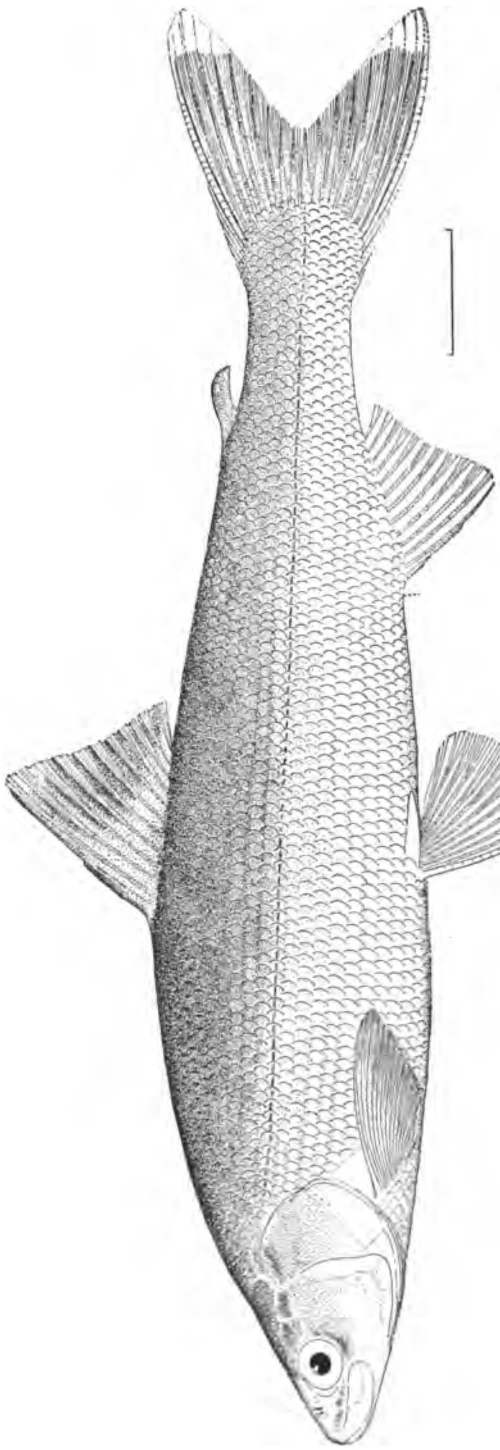
This is apparently the most abundant species of whitefish in the headwaters of the Yukon. The young were very abundant in Lake Bennett, where many examples were seined in shallow water. It appeared to be less common at Caribou Crossing.

One large example was obtained, August 5, by Dr. Gilbert in Wood River at the upper trap. Gillrakers 6+8 and 8+10, short, blunt, and weak; scales 10–101–8.

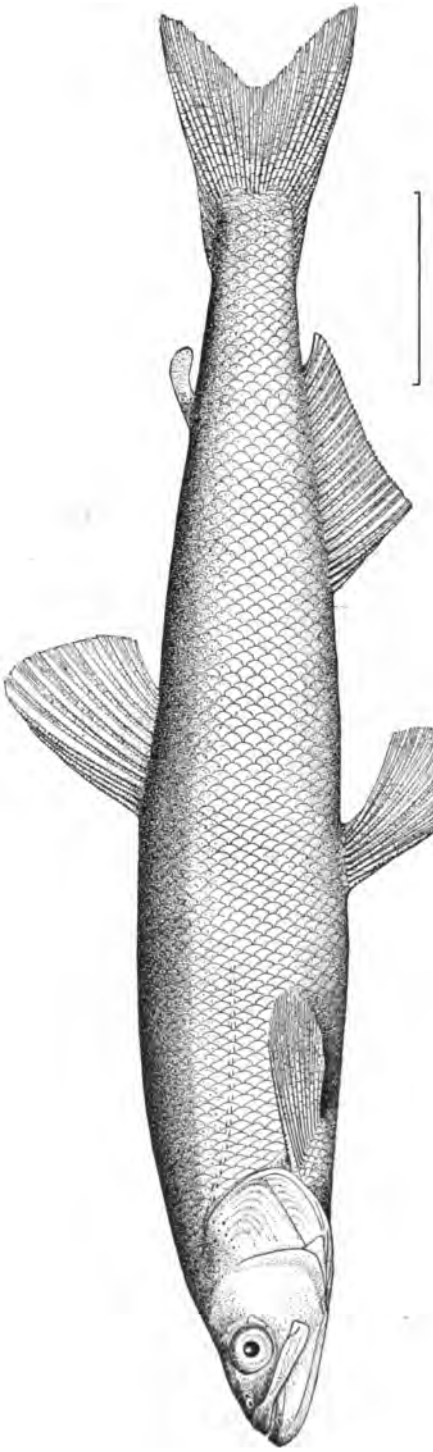
Color in life, light olive; scales darker edged, sides silvery; 13 diffuse, roundish, dusky blue spots along lateral line and 2 or 3 above it posteriorly; vestiges of parr-marks; upper fins very slightly reddish olive, lower bright creamy orange; opercle and shoulder bar creamy orange.

At Caribou Crossing this whitefish is of considerable importance as a food fish. The principal supply is said to come from Lake Atlin, where it is caught in winter as well as at other seasons. It is doubtless common in all suitable waters in the Yukon Basin.

This species has previously been recorded from the following Alaskan localities: Yukon River at Nulato and Fort Yukon (Bean 1882); Yukon River at Nulato and Unalakleet River (Nelson 1887); and Yukon River at Fort Yukon (Turner 1886).



1. ARGYROSOMUS ALASCANUS SCOFIELD. TYPE.



2. OSMERUS ALBATROSSIS JORDAN & GILBERT. TYPE.

21. **Coregonus nelsoni** Bean. *Nelson's Whitefish.*

We have a single specimen, no. 2927, 12 inches long, collected in Lake Bennett, British Columbia, July 20, 1903.

Originally described by Bean (1884) from Nulato, and since recorded from Middle Kobuk River (Townsend 1887), Point Barrow (Murdoch 1885), Nulato and Andreafski, Yukon River (Nelson 1887), and Grantley Harbor (Scofield 1899).

22. **Argyrosomus pusillus** (Bean). *Least Whitefish.*

Six specimens, 9.75 to 10.5 inches long, obtained at Caribou Crossing, and 8 specimens, 4.5 to 10 inches long, seined in Lake Bennett. The 4.5-inch Lake Bennett specimen is described as follows:

Head 4.67 in body; depth 5.5; eye 3.75 in head; dorsal 10; anal 12; ventral 11; scales 10–90–8.

Body rather elongate, compressed; mouth oblique, gape rather small, extending back about half the length of the maxillaries; lower jaw considerably projecting; maxillary broad, somewhat curved, not extending much beyond the anterior margin of orbit, its length 3.13 in head; mandible long, reaching to below middle of pupil, 2.3 in head; teeth almost microscopic, in both jaws, none on tongue; gill-rakers long, slender, and numerous, 10+26 and 13+28; dorsal high, its longest ray (about the third) about 1.3 in head and about twice length of base; base of dorsal 2.5 in head; dorsal rays shortening rapidly after third and fourth, leaving the margin of the fin very slightly concave; insertion of dorsal midway between tip of snout and a point about half way between adipose and caudal fins; caudal large, equally forked, both lobes and indentation acutish; anal low, its longest ray 2.25 in head, its base 2 in head, its posterior margin slightly concave; ventrals inserted somewhat behind origin of dorsal, reaching about two-thirds distance to origin of anal, the length of their longest rays about 1.3 in head; pectoral equaling ventral.

Bluish above, with minute black punctulations; sides below lateral line and a short distance above, silvery, belly white; dorsal and caudal almost imperceptibly dusky; other fins wholly plain; iris silvery, a narrow blackish ring about the orbit, plainest above and below.

This little fresh-water herring is probably not so abundant in the Yukon basin as the two preceding species.

The species was originally described by Bean (1889) as *Coregonus pusillus* from Kuwuk (Kobuk) River. He had previously recorded it in Cruise of the Corwin (1889) as *Coregonus merckii* var., from Hotham Inlet, Kotzebue Sound. It has also been recorded by Bean (1882) from St. Michael and northern Alaska; by Nelson (1887) from Andreafski, Yukon River, and by Scofield (1899) from Grantley Harbor and Barter Island near the mouth of the Mackenzie River.

23. **Argyrosomus laurettæ** (Bean).

Originally described by Bean (1882) as *Coregonus laurettæ* from Point Barrow and Port Clarence, and recorded by him also from the Yukon River at Nulato. Other records are as follows: Yukon River at Nulato (Nelson 1887); Meade and Kuaru rivers and Elson Bay (Murdoch 1885); and Nushagak and Naknek rivers (Gilbert 1895).

24. **Argyrosomus lucidus** (Richardson).

The only record for this species is Hershel Island (Scofield 1899).

25. **Argyrosomus alascanus** Scofield. (Pl. XIV, fig. 1.)

Originally described from Point Hope and Grantley Harbor (Scofield 1899); not yet known from any other place.

26. Stenodus mackenzii (Richardson). *Inconnu.*

Although no specimens were obtained by us, this species is known to occur in the headwaters of the Yukon. It has been reported to us by Messrs. Osgood and Maddren, who saw it in the Yukon in 1900. Mr. Presnell, of Chignik Bay, says that he saw an example 10 inches long at Eagle City in 1898 which had been taken through an air hole in the ice, and he thinks he saw another, weighing 3 or 4 pounds, on Forty-mile Creek.

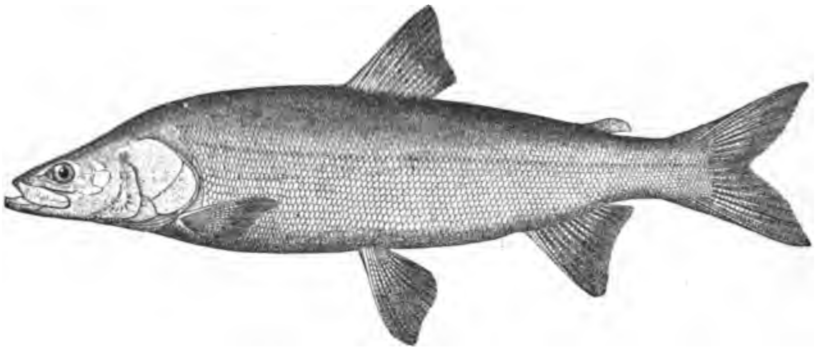


FIG. 9.—Stenodus mackenzii (Richardson).

Townsend (1887) records one specimen taken in the Middle Klawak (Kobuk) in August, 1885; Nelson (1887) records it from the Yukon at Nulato, Kotlik, and Andreafski; Turner (1886), from St. Michaels; and Scofield (1899) from the Mackenzie River.

27. Oncorhynchus gorbuscha (Walbaum). *Humpback Salmon; Pink Salmon.* (Pl. XXIII—XXVI.)

The humpback salmon is the most abundant salmon in Alaskan waters. It exists in millions, swarming everywhere along the shores and in waters near the sea, in streams, brooks, lakes, swamps, and brackish lagoons—in fact, in all places where fresh water, however little, may be found. It is ordinarily not found far from shore, and does not run up the streams for great distances. It does not frequent the larger rivers, and is therefore almost unknown in the Sacramento and Columbia, and even in the Fraser; but in the smaller streams it is found practically everywhere from California to Bering Sea, wherever a stream of fresh water, however small, enters the sea. Dr. Bean records it from Refuge Cove, Cook Inlet, and St. Paul, Kodiak Island; also from Colville River. Townsend (July 2 to August 25, 1885) found it in the Middle Kobuk River; not more than a half dozen individuals were seen, however, among the large numbers of fishes examined at every village of natives. Scofield (1899) found this species at Port Clarence about the middle of July, at which time it was beginning to run up the river back of the inner harbor. Gilbert (1895) says:

> The humpback salmon was seen by us at Port Möller on the northern side of the Alaskan Peninsula, during two visits, which included the first two weeks and the last week of July, 1890. During the first part of this month they were running in small numbers, and, as a few scattered ones only had been taken at Unalaska up to June 16, 1890, it is safe to indicate the first of July as the beginning of their appearance on that part of the coast. In the early part of their run they proved a very acceptable fish, but later they rapidly deteriorated. On our return to Unalaska, July 31, 1890, we learned that they had been running for several weeks, and during several visits in the month of August they were found in incredible numbers crowding into the mouths of the small streams which flow into Captains Harbor. Both pools and shallows seemed full of them and large numbers were dying within a few hundred yards of the beach. The spawning season appeared to begin early in August.

According to Murdoch (1885), humpback salmon occur sparingly at Perignak, Elson Bay. Nelson (1887) states that the run at St. Michael begins about the middle of June and that the fish continue rather numerous until the end of July. They were seen in abundance at all places visited by us in July and August. On July 8 some were taken in a gill net in Yes Bay. At Klawak they are plentiful and unusually large, running about 14 to the case in canning. Usually 20 to the case is a fair average, though they often run as small as 25 to 30 to the case.

At Afognak Falls, August 3, humpback salmon were found running in great numbers; they were seen in all parts of the stream below the falls, some jumping, others in the water often with their fins sticking out. The falls are in several parts, three being of considerable height, and with quieter water between. The upper or main fall is far more serious, and the salmon make many unsuccessful attempts to ascend it. The lip of the fall is very irregular and broken in many places, and at different levels are found pools or corners with less turbulent water where the fish can rest on their way up.

Just below this fall is a large relatively quiet pool extending the full width of the stream and perhaps 100 feet down the stream. This pool was literally packed with salmon; they seemed to be lying nearly as close together as possible and there must have been many thousands of them. Nearly or quite all of them, unless disturbed, lay with their heads upstream. They were all restless and seemed to be moving about more or less, usually trying to get nearer the fall—some pushing upward to the edge of rough water, then jumping wildly, sometimes gaining a little, but more often hitting the bank or some projecting rock or swift water and gaining nothing. Immediately under the fall they were jumping all the time. During the hour of observation there was scarcely a moment when one or more salmon could not be seen in the air or making their way against the nearly vertical current. The vantage ground from which they started was not good and the jumping appeared to be aimless and at random. Often they would jump straight up when some distance below the fall, frequently the wrong way, sometimes even downstream; sometimes striking the bank or a projecting rock, to be thrown back into the water, only to try the leap again. Occasionally a salmon which had reached the foot of a descending sheet of water would, with better judgment, jump toward the sheet and perhaps strike part of the way up, where it would maintain itself for a moment, perhaps advancing a short distance, but finally losing, to be carried or dashed, sometimes sidewise, sometimes headforemost, back into the pool below. During all the time of observation by the authors not a single salmon was seen to make the fall, but others of the party saw some succeed, and in the stream above the falls were seen several salmon that of course had gotten over. Into one pool easy of access, at the foot of the fall and containing as many salmon as it could possibly hold, one of us put his hand to lift a salmon out. By closing the hand over the gills it was possible to hold on to the fish without any difficulty, and so long as this succeeded the other fish took no alarm, but when one escaped it and all the others scurried down the falls in the most reckless way.

The entire stream from the falls to its mouth was well filled with salmon. Nearly all appeared to be humpbacks, although there were evidently a few sockeyes among them. Nearly all of both species were fresh from the sea and apparently in excellent condition.

In many places humpback salmon were seen jumping, in bays, passages and river mouths. At Sitka (August 20) boys were seen gaffing them in Indian River near its mouth. The males were greatly humped. All reports were to the effect that the run in the streams near Sitka was unusually large in 1903. The same was true at Killisnoo. We often saw humpback salmon along the shore where the only fresh water was seepage through the sand and gravel. They would often throw themselves out on the beach in their efforts to reach fresh water. Humpbacks are said to occur in the Yukon in July and August, though in limited numbers. We seined large numbers on July 25 at Pablof Bay, southeast Alaska; also at Sitkoh Bay, July 26. The species was noted also in Silver Creek near Sitka, July 29. Fry 1.3 inches long were taken May 22 with a lot of coho fry in sloughs or little pools along the Karluk River near its source.

The run of humpbacks extends, perhaps, through a longer period than that of any other species. In Southeast Alaska it begins in June and continues until September or even later in some places. Northward the period is somewhat shorter. On Puget Sound and southward it is more prolonged and continues late in the fall. As already stated, the humpback salmon as a rule do not ascend streams to great distances. If they enter large rivers at all they are apt to run into the first small tributary stream which they reach. They prefer, however, the smaller coastal streams, and are therefore not often seen in numbers at any distance from the sea.

They are quite persistent, and, in a measure, successful in their efforts to ascend streams in which considerable falls occur. Observations similar to those on their attempts to ascend Afognak Falls were made at Pablof Falls July 25, and at Dorr Falls, Naha Stream, August 30, and indicate that the humpback jumps quite as well as any of the other species of salmon. Where the water conditions—depth, current, width, etc.—are favorable it can probably make a vertical jump of 10 feet, but to ascend a fall with that vertical height frequent attempts would probably be made before success was attained, as the jumping appears to be more or less at random. It is perfectly evident that the salmon does not select a particular point on or near the lip of the falls where it proposes to strike; it simply jumps aimlessly, and sooner or later strikes the fall at a place where it is able to maintain itself and from which it can ascend into more quiet water above the falls.

Unlike the sockeye, this salmon does not refuse to enter streams which have no lakes in their headwaters. It seems to be entirely indifferent as regards this stream character; it selects its spawning beds in streams with or without lakes in their course. If in a stream with lakes, the beds may be in the stream above the lake, below the lake, or even in the lake itself. If there be one essential feature, aside from temperature, it is probably that the stream must be a relatively small one.

The humpback is the smallest of the 5 species of Pacific coast salmon. The results of a large number of measurements and weights are shown in the table which follows:

LENGTHS AND WEIGHTS OF HUMPBACK SALMON.

Locality and date.	Number examined.	Sex.	Length.			Weight.			Average for all.	
			Maximum.	Minimum.	Average.	Maximum.	Minimum.	Average.	Length.	Weight.
			Inches.	*Inches.*	*Inches.*	*Lbs.*	*Lbs.*	*Lbs.*	*Inches.*	*Pounds.*
Shipley Bay (Aug. 24)	57	♂	26.00	19.25	22.65	6.00	2.25	3.97	22.42	3.77
	59	♀	23.75	19.5	22.20	4.5	2.00	3.55		
Bear Harbor	30	♂	26.75	20.75	22.99	7.00	3.00	4.63	23.25	4.00
	70	♀	24.25	18.25	23.87	5.75	2.00	3.73		
Port Ellis, Home Stearn (Aug. 22)	44	♂	26.50	20.00	23.25	7.00	2.50	4.26	22.33	4.06
	56	♀	24.00	17.00	21.60	5.50	2.00	3.91		
Sukkwan (Aug. 28)	42	♂	25.75	19.00	22.47	7.00	2.75	4.02	22.13	3.93
	59	♀	23.75	19.00	21.80	5.5	2.50	3.86		
Hunter Bay (Aug. 28)	35	♂	26.75	21.75	24.33	7.00	4.00	5.24	23.09	4.62
	65	♀	25.00	19.5	22.43	6.00	2.5	4.28		
Funter Bay (July 23)	92	♂	....	....	21.89	....	....	4.16	....	....
	108	♀	....	....						
Do	7	♂	....	....	23.61	....	....	5.57	23.17	4.83
	11	♀	....	....	22.87	....	....	4.36		
Yakutat (Aug. 18)	4	♂	27.00	22.00	24.25	6.00	5.00	5.5	23.00	4.64
	7	♀	23.00	21.00	22.3	5.00	3.00	4.14		
Litnik Bay (Aug. 3)	40	♂	....	....	21.9	....	....	3.9	21.6	3.8
	10	♀	....	....	21.00	....	....	3.7		
Klawak	53	♂	27.00	23.00	24.80	8.00	4.00	5.66	23.78	4.84
	97	♀	25.00	20.00	23.21	6.00	2.00	4.39		
Cleveland Passage (July 13)	28	♂	25.25	20.00	22.50	8.00	2.00	4.85	22.46	4.77
	7	♀	24.00	20.00	22.86	5.5	3.00	4.42		
Yes Bay (July 17)	71	♂	....	....	....	11.5	2.75	7.7	....	6.9
	52	♀	....	....	....	7.5	3.5	5.9		
Kegan (Aug. 16)	41	♂	....	....	....	7.75	3.00	5.1	....	4.7
	59	♀	....	....	....	6.00	2.5	4.4		
Nowiskay (Aug. 19)	41	♂	....	....	....	9.00	3.00	5.1	....	4.7
	59	♀	....	....	....	5.5	3.5	4.5		
Quadra (Aug. 6)	97	♂	....	....	....	8.5	3.00	5.65	....	5.2
	108	♀	....	....	....	7.00	2.75	4.8		
Karta (July 26)	61	♂	....	....	....	10.00	3.25	5.3	....	4.7
	91	♀	....	....	....	6.75	2.5	4.4		
Karta (Aug. 2, 1904)	50	♂	....	....	....	7.00	2.5	4.8	....	4.55
	15	♀	....	....	....	6.00	3.25	4.4		
Scowl Arm (Aug. 2)	50	♂	....	....	....	7.5	2.5	4.8	....	4.7
	20	♀	....	....	....	5.25	3.25	4.6		
Wood River (July 19)	4	♂	21.25	19.00	21.062	2.5	2.00	2.375	19.972	2.333
	5	♀	20.75	18.75	19.5	3.00	2.00	2.3		
Nushagak River (July 22)	62	♂	24.00	19.00	21.487	6.00	2.5	4.032	21.004	3.809
	30	♀	20.75	18.25	20.00	4.25	2.5	3.35		

Three dozen humpback salmon (both sexes) were weighed at the cannery at Wrangell, July 13. The average weight was 5.8 pounds, the average length 24 inches. At the cannery of the Thlinket Packing and Trading Company, July 23, 30 fish (both sexes) gave an average weight of 4.2 pounds and an average length of 24.46 inches.

A male humpback taken in a gillnet in Yes Bay, July 9, was 25 inches long and weighed 7 pounds.

From the above (omitting those weighed in 1903 and 1904 by Mr. Chamberlain, for which the lengths are not given) it appears that the largest male humpback examined was 27 inches in total length and that the maximum weight was 8 pounds. The smallest male was 19 inches long and the minimum weight 2 pounds. The largest female was 25 inches long and the heaviest weighed 5.5 pounds. The smallest female was 17 inches long and the minimum weight was 2 pounds. The average of 341 males was in length, 23.19 inches, in weight 4.3 pounds; of 441 females, length 22.59 inches, weight 4 pounds. The average length of the 782 fish (both sexes) was 22.64 inches, and the average weight 4.13 pounds. The examples weighed by Mr. Chamberlain at various places in 1903 and 1904 appear to be somewhat heavier than those examined by us. The 11.5-pound male weighed by him at Yes Bay, July 17, is 3.5 pounds heavier than any examined by us. And the heaviest female (7.5 pounds) examined by him was 2.5 pounds heavier than the heaviest weighed by us. The average weight of 1,597 fish (782 weighed by us, 815 by Mr. Chamberlain) was 5.25 pounds. The Yes Bay humpbacks appear to be heavier than any others.

An examination of these figures and the detailed data on which they are based does not, however, indicate that any geographic races can be recognized. While the averages for the different streams show considerable differences in some instances, the individuals from any one stream lack homogeneity and show a range of variation in length and weight great enough to include that of the different streams.

The humpback salmon is known to the Russians as *gorbuscha* and to the trade as pink salmon. Not until recently in the history of the salmon-canning industry has it been utilized. Its flesh is pale or pink in color, less firm in texture, and with less of the salmon flavor characteristic of the sockeye and chinook. For these reasons canners were slow to utilize it. A few years ago, however, a number of enterprising canners began putting up this species under the name of pink salmon and during the last five or six years the industry has developed enormously. The pack of many canneries which originally put up nothing but reds consists now largely, in some cases almost wholly, of pinks. Many canneries which at first utilized the humpbacks only at the end of the season in order to make up their guaranty are now canning them whenever they can get them.

Although as a canned product not ranking as high as the red, the king, or the coho, pink salmon is a delicious article, palatable, very nutritious, and thoroughly wholesome in every way. As a food product its place is now established and in the future it will only increase in popularity. When fresh and directly from the sea it is, next to the king, generally regarded as the best of all the salmons as a fresh fish. As a salted fish also it ranks high, and salted humpback bellies are esteemed a great delicacy. This fish, however, does not keep well in the fresh state, the flesh becoming soft soon after the fish is taken out of the water and becoming tainted in forty-eight hours or less, even in the cool climate of Alaska. By the time the fish has reached the spawning beds or even the mouths of the rivers, its flesh has lost most of the oil it had and is then almost worthless as food. Only when caught some time before it would have entered the streams is it fit for food.

The catch of humpbacks in 1906 was second in value only to the red salmon. In that year the total number of humpback salmon utilized in the Alaskan fisheries, as given by the Alaska salmon agents, was 7,707,999. The bulk of these were canned, though many were utilized in other ways, as fresh, salted, etc. Reducing the entire catch to the basis of canned salmon, the total product for 1906 equaled 357,428 cases which, at average current prices, was valued at $1,061,463.

The Beginning and Ending of Commercial Fishing for Humpback Salmon at Various Fishing Stations in Alaska, 1900 and 1904–1906.

Note.—The fact that the name of a river is given does not necessarily mean that fishing is carried on in the river itself; in many instances the fishing station is in the vicinity of the stream and its name has been used in order more clearly to locate the streams. The dates given do not necessarily mean the beginning and ending of the run for each stream, as the fish may have been running for some time before the cannery men were able to fish the stream, and the pack may have been obtained and fishing stopped before the end of the run.

Waters.	1900.		1904.		1905.		1906.	
	Fishing began—	Fishing ended—	Fishing began—	Fishing ended—	Fishing began—	Fishing ended—	Fishing began—	Fishing ended—
Bering Sea.								
Nushagak Bay	....	....	June 8	Aug. 6	June 19	June 30	June 16	Aug. 4
Wood River	....	....	....	....	....	....	July —	
Kvichak River	July 15	July 25	June 21	Aug. 5	June 26	July 26	June 20	Aug. 7
Naknek River	July 23	July 28	July 1	Aug. 2	June 14	July 30	June 21	July 31
Central Alaska.								
Chignik Lagoon and River	July 2	Aug. 19	June 10	Aug. 14	....	....	....	
Kodiak Island: Karluk	....	....	July 26	July 26	....	....	....	
Cook Inlet (Kasilof)	....	....	....	....	....	....	Aug. 8	Aug. 13
Prince William Sound: Cordova Bay	....	....	July 2	July 12	....	....	....	
Southeast Alaska.								
Yakutat Bay: Humpback Creek	....	....	Aug. 1	Aug. 20	July 26	Aug. 8	....	
Situk River	....	....	July 15	July 30	July 14	Aug. 10	July 5	Aug. 11
Ankau River	....	....	July 20	Aug. 2	....	....	do	July 31

The Beginning and Ending of Commercial Fishing for Humpback Salmon at Various Fishing Stations in Alaska, 1900 and 1904–1906—Continued.

Waters.	1900.		1904.		1905.		1906.	
	Fishing began—	Fishing ended—	Fishing began—	Fishing ended—	Fishing began—	Fishing ended—	Fishing began—	Fishing ended—
Southeast Alaska—Continued.								
Ankau Slough			July 13	July 27	July 26	Aug. 8	do	Aug. 9
Ahrnklin River			do	Aug. 17	[No run.]		July 10	Do.
Surge Bay, Yakobi Island					July 25	Aug. 20	July 25	Aug. 11
Takanis Bay, Yakobi Island					July 20	Aug. 27	Aug. 3	Aug. 3
Cape Edward, off Chichagof Island					Aug. 21	Aug. 31		
Portlock Harbor, Chichagof Island					Aug. 10	Aug. 10	Aug. 25	Aug. 25
Cross Sound:								
Soapstone Point, Yakobi Island					July 31	Aug. 1		
Lisianski Strait					July 28	Aug. 3	July 25	Aug. 7
Port Althorpe, Chichagof Island					July 27	Aug. 5		
James Bay (?)					do	July 27		
Kochtakeene (?)					Aug. 4	Aug. 13	July 25	Aug. 13
Icy Strait:								
Dundas Bay					July 24	July 27		
Glacier Bay—								
Bartlett Bay					July 29	July 29	July 17	July 28
Pleasant Island			July 1	Aug. 24	June 22	Sept. 14	July 12	Sept. 6
Lynn Canal			June 25	Sept. 15			June 26	Sept. 22
Chilkoot Inlet and River			June —	Sept. —				
Eagle River					July 15	Sept. 15	June 21	Aug. 22
Tee Harbor			July 1	Sept. 7				
Lena Cove					July 1	Sept. 15		
Point Louisa					do	do		
Auk Bay			June 25	Sept. 7	do	do		
Chatham Strait:								
Funter Bay, Admiralty Island			June 1	Sept. 15	July 3	Sept. 16	June 21	Do.
Basket Bay, Chicagof Island			July 12	Aug. 24				
Flat Bay, Chicagof Island			July 20	Aug. 25				
White Rock, Chicagof Island			do	do				
Sitkoh Bay, Chicagof Island			July 12	Aug. 24				
Peril Strait, Rodman Bay, Baranof Island			July 1	do				
Bay of Pillars					July 25	Aug. 20		
North Arm, Kuiu Island							July 25	Aug. 30
South Arm, Kuiu Island	July 15	Aug. 31					do	Do.
St. Michael Bay: Kuiu Bay, Kuiu Island			July 20	Aug. 1	July 25	Aug. 15	July 20	Do.
Stephens Passage			June 25	Sept. 7	July 1	do		
Taku Inlet			July 1	do	do	do		
Port Snettisham	July 25	Aug. 16	July 4	Aug. 4	do	do		
Seymour Canal							June —	Aug. —
Pleasant Bay, Admiralty Island			July 20	Sept. 1				
Frederick Sound:								
Saginaw Bay, Kuiu Island							July 23	Aug. 27
Portage Bay, Kupreanof Island			Aug. 19	Aug. 23				
Cleveland Passage							July 17	Do.
Wrangell Strait:								
Petersburg Creek, Mitkof Island			July 23	Aug. 22	July 15	Aug. 31	July 10	Aug. 28
Blind Point, Mitkof Island					July 1	Oct. 1	Aug. 14	Do.
Duncan Canal, Kupreanof Island			July 26	Aug. 25	July 16	Sept. 6	July 23	Aug. 25
Sea Otter Sound: Fokhini Stream, Kosciusko Island							Aug. 4	Sept. 9
Iphigenia Bay: Warm Chuck, Heceta Island							Sept. 3	Sept. 5
Tonowek Bay:								
Sarkar, Prince of Wales Island					July 15	Aug. 31		
Nahakay, Prince of Wales Island							Aug. 8	Aug. 24
Gulf of Esquibel: Shineha Creek, Prince of Wales Island			Aug. 3	Aug. 8			Aug. 1	Aug. 9
San Alberto Bay:								
Klawak Inlet, Prince of Wales Island	July 16	Aug. 27	Aug. 1	Aug. 26	July 29	Aug. 29	July 24	Sept. 1
Big Harbor, Prince of Wales Island							do	Do.
Tlevak Strait: Skookum Chuck							Aug. 8	Sept. 3
Cordova Bay: Hetta, Prince of Wales Island							July 24	Sept. 1
Sumner Strait:								
Shipley Bay, Kosciusko Island							July 27	Aug. 31
Shakan Bay, Prince of Wales Island							Aug. 30	Aug. 30
Calder and Elcopdam Bay, Prince of Wales Island							July 27	Do.
Hole-in-the-Wall, Prince of Wales Island							July 30	Aug. 23
Seclusion Harbor, Kuiu Island			Sept. 1	Sept. 8				
Point Barrie Stream, Kupreanof Island			July 19	Aug. 24	July 14	Aug. 28	July 15	Do.
Totem Bay, Kupreanof Island			Aug. 12	Sept. 6	Aug. 25	Aug. 25	Aug. 17	Aug. 24
Red Bay, Prince of Wales Island			July 23	Aug. 28	July 2	Sept. 3	July 25	Aug. 31
Blind Slough, Kupreanof Island			Sept. 1	Sept. 4				
Stikine River					July 23	Aug. 25	July 9	Aug. 4
Zimovia Strait:								
Olive Bay, Etolin Island			July 25	Aug. 1	July 12	July 28	July 20	Aug. 1
Thoms (Old Village) Stream, Wrangell Island	Aug. 5	Aug. 18					Sept. 1	Sept. 3

THE BEGINNING AND ENDING OF COMMERCIAL FISHING FOR HUMPBACK SALMON AT VARIOUS FISHING STATIONS IN ALASKA, 1900 AND 1904–1906—Continued.

Waters	1900.		1904.		1905.		1906.	
	Fishing began—	Fishing ended—	Fishing began—	Fishing ended—	Fishing began—	Fishing ended—	Fishing began—	Fishing ended—
Southeast Alaska—Continued.								
Clarence Strait:								
Salmon Bay, Prince of Wales Island			July 25	Aug. 13	July 9	Sept. 6	June 15	Sept. 4
Eagle Creek, Prince of Wales Island			do	Sept. 4	July 1	Sept. 1	do	Do.
Whale Passage, Prince of Wales Island					do	Sept. 8	do	Sept. 10
Lake Bay, Prince of Wales Island					do	Sept. 1	do	Sept. 4
Coffman Cove, Prince of Wales Island							do	Do.
Valdemar Bay, Prince of Wales Island			Aug. 12	Aug. 14				
Steamer Bay, Etolin Island			do	Aug. 21				
Rocky Bay, Etolin Island			July 27	Sept. 10	July 19	Aug. 8	June 15	Sept. 4
Ratz Harbor, Prince of Wales Island					July 1	Sept. 1	do	Do.
Ernest Sound—								
Union Bay, Cleveland Peninsula			Aug. 1	Aug. 8	Sept. 2	Sept. 4	July 17	Aug. 14
Vixen Point, Cleveland Peninsula							July 8	Aug. 26
Etolin Cove, Etolin Island (?)							Aug. 25	Aug. 30
Menefee Inlet, Etolin Island							July 25	Aug. 5
Santa Anna Bay, Cleveland Peninsula							Aug. 27	Aug. 27
Point Warde, Cleveland Peninsula							June 27	July 28
Anan Creek, Cleveland Peninsula							June 15	Sept. 4
Midway Cove (?)							July 14	Aug. 30
Meyers Stream, Cleveland Peninsula							Sept. 1	Sept. 3
Thorne Bay, Prince of Wales Island							Aug. 1	Sept. 4
Kasaan Bay—								
Karta Bay, Prince of Wales Island	July 18	Aug. 20					July 28	Sept. 3
Twelve Mile Arm, Kina Stream, Prince of Wales Island							do	Do.
Skowl Arm, Prince of Wales Island					Aug. —	Sept. —	do	Sept. 5
Behm Canal—								
Naha Stream, Revillagigedo Island			July 31	Sept. 1				
Yes Bay, Cleveland Peninsula	July 15	Sept. 14	July 19	Aug. 19				
Unuk River							Aug. 2	Aug. 29
Chickamin River			Aug. 15	Aug. 22				
Checats Stream	July 15	Aug. 16	July 11	Aug. 17			July 17	Aug. 3
Smeaton Bay			Sept. 3	Sept. 3				
Tongass Narrows—								
Ward Cove, Revillagigedo Island	Aug. 3	Sept. 7	Aug. 5	Aug. 11			July 23	Sept. 6
Ketchikan Creek, Revillagigedo Island							Aug. 20	Sept. 5
Cholmondeley Sound			Aug. 1	Aug. 28	Aug. 5	Sept. 1	July 30	Sept. 15
Dora Bay, Prince of Wales Island			July 9	Aug. 20	July 29	Aug. 29	July 28	Sept. 6
Peter Johnson Stream (Dolomi), Prince of Wales Island	July 23	Sept. 1	Aug. 5	Sept. 8	Aug. 1	Aug. 28	June 30	Sept. 6
Moira Sound—								
North Arm, Prince of Wales Island			July 14	Aug. 22	July 29	Aug. 29	July 13	Sept. 8
Shalclair, Prince of Wales Island					Aug. 8	do		
Browns, Prince of Wales Island					do	do		
South Arm—								
Kegan Stream, Prince of Wales Island			Aug. 2	Sept. 1	July 29	Aug. 29	July 11	Sept. 6
Nowiskay Stream, Prince of Wales Island			Aug. 9	Aug. 25				
Old Johnson Stream, Prince of Wales Island			Aug. 4	Aug. 31			July 13	Sept. 3
Nichols Passage—								
Blank Inlet, Gravina Island							Aug. 2	Aug. 29
Bostwick Inlet, Gravina Island			Aug. 22	Sept. 7				
Hemlock Island, off Annette Island			Aug. 6	Aug. 31	Aug. 7	Aug. 14		
Tain, Annette Island			July 27	do	Aug. 2	Sept. 1	July 26	Sept. 13
Tamgas Harbor, Annette Island	July 24	Sept. 1	Aug. 3	do	July 29	do	July 24	Aug. 29
Nadzaeer, Annette Island			Aug. 16	Aug. 23	Aug. 7	Aug. 21		
Revillagigedo Channel:								
George Inlet, Revillagigedo Island	July 20	Sept. 4	July 7	Sept. 5			July 6	Sept. 1
Carroll Inlet Revillagigedo Island			Aug. 14	Aug. 21				
Thorne Arm, Revillagigedo Island							Aug. 24	Aug. 24
Hassler Harbor, Revillagigedo Island			Aug. 28	Sept. 3				
Nancy Haines (?)							Sept. 14	Sept. 19
Duke Island							Aug. 8	Aug. 31
Boca de Quadra	July 15	Aug. 12	July 9	Aug. 27			July 21	Aug. 26
Kah Shakes Cove							July 24	Aug. 23
Foggy Bay			Sept. 1	Sept. 3				
Nakat Inlet							Aug. 7	Aug. 10

28. Oncorhynchus keta (Walbaum). *Dog Salmon; Chum; Calico Salmon.* (Pl. XXVII and XXVIII.)

The dog salmon is a species of wide distribution. On the American coast it occurs from San Francisco northward at least to Hotham Inlet, Kotzebue Sound, and Bering Strait (Bean 1882). It is found also on the Asiatic coast and is the principal salmon in Japanese waters, where it is known as *saké*. It is not abundant on the coast of California, but increases in numbers northward, being most abundant in Southeast Alaska. Dr. Bean records it from Old Sitka, from Alexandrovsk, Cook Inlet, and from St. Paul, Kodiak Island. Mr. Hess reports its occurrence at Teller in a stream flowing into Port Clarence. In the streams of Seward Peninsula it runs from July 15 to August 31; then comes a mixture of dog salmon and silver salmon. The species was found by Mr. Hess on July 1, 1900, near Council, in the lower Fish River, which flows into Golofinin Bay.

It is said that the run of salmon in the Tanana is not great enough for canning purposes; but in the Yukon at the mouth of the Tanana the run of salmon (all species) is probably enough to justify commercial fishing. Mr. Townsend (1885) records it as the principal salmon of the Kobuk River.

According to Mr. E. W. Nelson (1880) the dog salmon is abundant at St. Michael. The run begins at the end of June and is over by the last of July. On account of its great abundance, this is to the Eskimo the most valuable food fish about the shores of Bering Sea and the lower Yukon and Kuskoquim rivers. On the lower Yukon the main run occurs between the last of June and the end of July. The fish is rarely taken at St. Michael before June 12.

Dog salmon are said to go through Chilkoot Lake and spawn in its inlets, but we have no positive knowledge to this effect. At Sitka on August 20, where boys were seen gaffing salmon at the bridge across Indian River, several dog salmon were noted.

Dog salmon were seen by us at most of the canneries visited, especially in August. We saw them at Taku Inlet (July 14), Killisnoo and Sitkoh Bay (July 26), Chignik (August 9 and 10), Kell Bay (August 23), Dundas Bay, Point Ellis (August 21), Funter Bay (July 23), Hunter Bay (August 28), Cleveland Passage (July 13), Pillar Bay and Loring.

The run of dog salmon in Alaska seems to come later than that of any other species except the coho. In Southeast Alaska the season is not at its height until late in August or September. Spawning fish have been taken in the vicinity of Fort Yukon in August and September. Like the humpback, the dog salmon seems to prefer the smaller, coastal streams. Although it runs to some extent in the larger rivers, such as the Columbia, Copper, and Yukon, it ordinarily does not ascend them to great distances. It is unknown in the headwaters of the Columbia; the records of "dog salmon" there and in the headwaters of other large rivers probably refer in most cases to spawning males of the chinook salmon, which are, in many places, popularly known as "dog salmon." This species is most abundant in small streams near the sea and in the small lower-course tributaries of the larger streams.

The dog salmon is second in size only to the chinook, as is shown by the following table. A total of 202 samples were examined. The average weight of these was 8.33 pounds, the average length, 29 inches. The largest male examined was 35 inches long and weighed 16 pounds; the smallest was 25.5 inches long and weighed 5 pounds. The largest female was 33 inches long and weighed 15 pounds, the smallest female was 25 inches long and weighed 7 pounds.

MEASUREMENTS AND WEIGHTS OF DOG SALMON.

Locality.	Number examined.	Sex.	Length.			Weight.			Average length.	Average weight.
			Maximum.	Minimum.	Average.	Maximum.	Minimum.	Average.		
			Inches.	*Inches.*	*Inches.*	*Pounds.*	*Pounds.*	*Pounds.*	*Inches.*	*Pounds.*
Chignik	1	♂	33.87			13.00			29.37	9.34
	3	♀	27.87	26.13	27.08	8.13	7.24	7.57		
Sukkwan	1	♂	32.75			10.00			30.87	10.00
	1	♀	29.00			10.00				
Funter Bay	2	♂	35.00	35.00	35.00	16.00	15.00	15.5	31.17	12.17
	4	♀	33.00	25.00	29.25	15.00	8.00	10.5		
Point Ellis	1	♂	31.50					16,00	31.50	16.00
Dundas Bay	1	♂	30.00					12.00	29.40	10.00
	3	♀			29.2			9.67		
Kell Bay	16	♂	32.50	26.25	29.80	12.00	6.00	8.44	29.17	8.29
	14	♀	30.50	27.50	28.45	9.00	7.00	8.11		
Cleveland Passage	1	♀	29.50			12.00			29.50	12.00
Nushagak River	15	♂	32.00	25.50	28.683	11.00	5.00	8.4	28.001	7.596
	11	♀	29.13	25.50	27.102	9.00	6.00	7.045		
Koggiung	1	♂	27.50			7.50			27.50	7.50
Ugashik River	59	♂	32.00	28.25	30.00	14.00	6.5	9.038	29.015	8.192
	68	♀	30.75	25.00	28.158	12.00	6.5	7.459		

As a food fish this species is inferior to all the other salmon. The inferiority, however, is more marked when the fish is canned than when otherwise utilized. The flesh is soft and spongy and does not lend itself readily to canning processes. It is pale in color and therefore not so attractive in appearance as that of the other species. When utilized fresh the fish takes a higher rank. It is coming more and more to be frozen and shipped east or abroad, and is meeting with much favor in that form. Considerable quantities are being dry-salted for the Japanese market. In Japan this species is highly prized and is a valuable product of the fisheries. It is the most abundant salmon in that country.

When fresh run from the sea the dog salmon is a handsome fish, plump and silvery, very attractive in appearance, and closely resembling the silver salmon. Later the dark of the back tends to form vertical bars which extend down on the sides. In the breeding season the body becomes largely dirty black, obscurely barred with dirty red, the jaws become greatly elongated and distorted, and the teeth show prominently. Frequently the flesh is dirty red and soiled white alternately in broad bands which, together with the banding on the surface, doubtless suggested the name calico salmon. The Russians call this salmon *hayko or lekai*, while to the Japanese it is *saké*. The trade name on our coast is chum.

Although the dog salmon does not yet rank high in popular favor, and while it is commercially the least valuable of the several species of salmon except the coho, it is nevertheless a valuable fish, one destined to become more and more appreciated as we learn better methods for its utilization. The flesh, though not so red nor so firm and flaky as in other species, is no less nutritious and no less wholesome. At present it is probably better to utilize it either fresh or by dry-salting rather than by canning.

During the season of 1906 the dog salmon fishery increased enormously over previous years. The total number of fish utilized was 3,259,384. Reducing the entire catch to a canned salmon basis it is equivalent to 273,459 cases, valued at $755,374.

THE BEGINNING AND ENDING OF COMMERCIAL FISHING FOR DOG SALMON AT VARIOUS FISHING STATIONS IN ALASKA, 1904–1906.

NOTE.—The fact that the name of a river is given does not mean that fishing is carried on in the river itself; in fact, the fish are nearly always caught before they enter the streams. In many instances the fishing station is in the vicinity of the stream and its name has merely been used to locate the station more clearly. The dates given do not necessarily mean the beginning and ending of the run for each stream, as the fish may have been running for sometime before the cannery men were able to fish the stream and the pack may have been obtained and fishing stopped before the end of the run.

Waters.	1904.		1905.		1906.	
	Fishing began—	Fishing ended—	Fishing began—	Fishing ended—	Fishing began—	Fishing ended—
Bering Sea.						
Nushagak Bay[a]	June 25	July 5	June 1	July 28	June 11	Aug. 4
Kvichak River	July 1	July 31	June 24	July 22	June 25	Aug. 7
Naknek River					June 23	July 30
Ugaguk River			June 23	July 25	June 15	July 25
Ugashik River	July 4	Aug. 1	June 13	July 28	June 18	July 31
Nelson Lagoon					June —	July —
Southeast Alaska.						
Icy Strait:						
Dundas Bay			Sept. 1	Sept. 1	Aug. 26	Aug. 31
Glacier Bay—Bartlett Bay			Aug. 26	Sept. 10	Sept. 5	Sept. 18
Pleasant Island	June 15	Oct. 8	June 22	Oct. 15	Aug. 15	Sept. 5
Excursion Inlet					Sept. 8	Sept. 18
Port Frederick, Chichagof Island			July 10	Oct. 15		
Lynn Canal	June 25	Oct. 8			June 26	Sept. 22
Chilkat Inlet and River	June 24	Sept. 23	Aug. 15		June 29	Do.
Eagle River					June 21	Sept. 5
Tee Harbor	July 1	Sept. 7				
Lena Cove			July 1	Sept. 15		
Point Louise			do	do		
Auk Bay	June 25	Sept. 7	June 25	do		
Chatham Strait:						
Funter Bay, Admiralty Island	June —	Sept. 15	June 19	Sept. 16	June 21	Sept. 5
Gut Bay			July 20	Oct. 27		
Bay of Pillars—						
North Arm, Kuiu Island			July —	Oct. —	July 20	Aug. 1
South Arm, Kuiu Island[b]						
St. Michael Bay—Kuiu Bay, Kuiu Island			July —	Oct. —	July 20	Aug. 1
Stephens Passage	June 25	Sept. 7	June 25	Sept. 15		
Taku Inlet[c]	July 1	do	do	do		
Port Snettisham[d]	July 4	Aug. 4	do	do		
Seymour Canal					June —	Aug. —

[a] 1900, June 19 to July 1.
[b] 1900, July 15 to August 31.
[c] 1900, August 15 to September 25.
[d] 1900, July 9 to September 24.

THE BEGINNING AND ENDING OF COMMERCIAL FISHING FOR DOG SALMON AT VARIOUS FISHING STATIONS IN ALASKA, 1904–1906—Continued.

Waters.	1904.		1905.		1906.	
	Fishing began—	Fishing ended—	Fishing began—	Fishing ended—	Fishing began—	Fishing ended—
Southeast Alaska—Continued.						
Frederick Sound:						
Security Bay, Kuiu Island			July 20	Oct. 27		
Saginaw Bay, Kuiu Island	Sept. 1	Sept. 20	...do...	...do...	July 23	Aug. 27
Port Camden, Kuiu Island			...do...	...do...	Aug. 30	Sept. 14
Cleveland Passage					July 17	Aug. 27
Wrangell Strait:						
Petersburg Creek, Mitkof Island					July 5	Aug. 22
Blind Point, Mitkof Island			July 20	Oct. 27	Aug. 14	Aug. 28
Duncan Canal, Kupreanof Island					July 9	Aug. 31
Sumner Strait:						
Calder and Elcopdam Bay, Prince of Wales Island					July 27	Aug. 30
Rocky Pass, Kuiu Island(?)			July —	Oct. —		
Point Barrie Stream, Kupreanof Island					July 7	Aug. 23
Totem Bay, Kupreanof Island					Aug. 17	Do.
Red Bay, Kupreanof Island					July 1	Aug. 31
Stikine River					July 4	Aug. 4
Zimovia Strait: Thoms (Old Village) Stream, Wrangell Island					Aug. 1	Sept. 3
Clarence Strait:						
Salmon Bay, Prince of Wales Island					June 15	Sept. 4
Eagle Creek, Prince of Wales Island			Sept. 14	Sept. 27	...do...	Sept. 6
Whale Passage, Prince of Wales Island			July 1	Sept. 1	...do...	Sept. 10
Lake Bay, Prince of Wales Island	Aug. 15	Sept. 15			...do...	Sept. 4
Coffman Cove, Prince of Wales Island					...do...	Do.
Rocky Bay, Etolin Island					...do...	Do.
Ratz Harbor, Prince of Wales Island					...do...	Do.
Ernest Sound—						
Union Bay, Cleveland Peninsula					July 17	Aug. 14
Vixen Point, Cleveland Peninsula					Aug. 8	Aug. 26
Menefee Inlet, Etolin Island					July 25	Aug. 5
Point Warde, Cleveland Peninsula					June 27	July 28
Anon Creek, Cleveland Peninsula					June 15	Sept. 4
Doris Bay (?)					Sept. 6	Sept. 8
Middle Arm (?)					Sept. 11	Sept. 16
Sunny Point (?)					Sept. 10	Do.
Meyers Stream, Cleveland Peninsula					Aug. 1	Sept. 3
Thorne Bay, Prince of Wales Island					...do...	Sept. 4
Kasaan Bay—						
Karta Bay, Prince of Wales Island					Aug. 28	Sept. 3
Twelvemile Arm—Kina Stream, Prince of Wales Island					...do...	Do.
Skowl Arm, Prince of Wales Island					Aug. 1	Sept. 5
Behm Canal—						
Yes Bay, Cleveland Peninsula[a]						
Unuk River					Aug. 4	Aug. 29
Checats Stream[b]						
Tongass Narrows—						
Ward Cove, Revillagigedo Island					July 23	Sept. 6
Ketchikan Creek, Revillagigedo Island					Aug. 20	Sept. 5
Cholmondeley Sound	Aug. 1	Nov. 1	Aug. 5	Nov. 7	July 30	Oct. 30
Dora Bay, Prince of Wales Island					Aug. 3	Oct. 24
Peter Johnson Stream (Dolomi), Prince of Wales Island					June 30	Sept. 14
Moira Sound—						
North Arm, Prince of Wales Island					July 13	Sept. 8
South Arm						
Keegan Stream, Prince of Wales Island					July 11	Sept. 6
Old Johnson Stream, Prince of Wales Island					July 13	Sept. 3
Nichols Passage—						
Blank Inlet, Gravina Island					Aug. 2	Aug. 29
Tain, Annette Island					Aug. 7	Sept. 3
Tamgass Harbor, Annette Island					Aug. 4	Aug. 29
Nadzaeer, Annette Island					Sept. 7	Sept. 12
Revillagigedo Channel:						
George Inlet, Revillagigedo Island					July 6	Sept. 1
Nancy Haines (?)					Sept. 14	Sept. 19
Duke Island					Aug. 11	Aug. 18

[a] 1897, July 17 to August 7; 1899, July 14 to September 13; 1900, July 21 to September 17.

[b] 1897, July 23 to August 2.

29. **Oncorhynchus tschawytscha** (Walbaum). *Chinook Salmon; King Salmon; Quinnat Salmon.* (Pl. XXIX and XXX.)

The chinook salmon is called king salmon or spring salmon in Alaska; spring or chinook salmon on Fraser River and Puget Sound; chinook, royal chinook, quinnat, or Columbia River salmon on the Columbia River, and Sacramento salmon in California. Where the Chinook jargon is spoken it is the *tyee*, which means king. Among the Russians it is called *tschavitche* or *tschawytscha*.

This is a salmon of wide distribution. It occurs on both coasts of the Pacific from Monterey Bay and China north into the Arctic Ocean, ascending all large streams. The most southern point on the California coast for which we have definite records is Monterey Bay, but its southern range doubtless extends somewhat farther down the coast. There is a record, on what authority we do not know, of its occurrence in the Ventura River, 300 miles south of San Francisco. However that may be, this important salmon is not uncommon in Monterey Bay, where considerable numbers are caught in spring and summer by trolling. In the Sacramento and Columbia rivers it is the principal salmon, far outnumbering all other species. It occurs in some numbers in other streams of Oregon and Washington, and is not uncommon in Puget Sound. It runs somewhat sparingly in the larger streams of British Columbia and Southeast Alaska, particularly the Fraser, Skena, Nass, Stikine, and Taku.

Throughout Southeast Alaska the king salmon is probably not uncommon, although the catch has not been considerable until recently. It is said that this fish can be taken by trolling any month in the year about Admiralty Island, particularly in the vicinity of Killisnoo. In 1905 and again in 1906 it was particularly common about Ketchikan and in Tongass Narrows, where it was taken in seines. It is also taken near Chilkat and Chilkoot. Usually the king salmon make their appearance at the time of the run of the herring, upon which they largely feed, and they follow up the smelt also, being found wherever that species occurs in numbers. The principal river in Southeast Alaska into which the king salmon run is the Taku, and the salmon taken in the various places mentioned above probably enter that stream for spawning purposes.

In 1906, from July 15 to 20, 100 king salmon were taken in gill-nets operated by an Indian in the vicinity of Burroughs Bay. They were all very large, some of them reaching a weight of 89 pounds. It is said they can be taken in that locality as early as May 15. Usually the Wrangell cannery counts on getting 4,000 to 8,000 king salmon from the Stikine River each year.

In 1897, 350 king salmon averaging 16 pounds each were salted at Killisnoo.

In Copper River, which flows into Prince William Sound, and the larger streams tributary to Cook Inlet, there is a considerable run of king salmon. They are said not to run in Alitak Bay, on Kodiak Island. They are, however, taken at Karluk, and other places on Kodiak Island and also on Afognak Island and the islands of the Alaskan Peninsula, though at no place in any abundance. In Nelson Lagoon, in 1906, those first caught were taken June 15. They continued to run until July 18, July 1 to 18 being the height of the season. The fish caught there ran 15 to the barrel.

In the Ugashik River, in 1906, those first caught were taken June 4. The king, red, and dog usually come together. The run of that season, as for five seasons past, was poor.

The king salmon occurs, though not abundantly, in the Nushagak River. In 1906 it was first seen on June 7, and the run for the year was greater than usual and the fish were larger. Small king salmon are here sometimes put up under coho labels. They also occur in considerable numbers in the Yukon. Important fisheries supplying the local demand are operated at Dawson, Eagle City, and Rampart. Rampart is 900 miles above the mouth of the Yukon, and the run was on at that place September 10. Several were taken, each weighing 20 pounds or more. They were full of spawn.

Late in July king salmon have become common in the upper Yukon beyond the boundary, being found in the middle and lower waters a month earlier. During the summer of 1897 a number of fishermen employed gill-nets at Dawson, Northwest Territory, readily taking king salmon of large size. Many fish were found weighing 40 pounds and over, and the prices received for them were so high as to make the business quite profitable. This point is 1,300 miles from the sea. They are said to run up the river at least as far as Caribou Crossing, 2,000 miles from the sea. Mr. Hess found them in China Slough of the Tanana for seven to nine days toward the end of July and in the Tanana itself for three weeks. On July 14, 1904, he observed the first king salmon at the Central Telegraph Station on Goodpaster River, 63 miles below its head. They are said to go 25 miles farther up this stream and to be very abundant later in the season. Nelson says (1887):

> This species is taken along the shores of Norton Sound immediately after the ice disappears in spring, my earliest date being June 6, 1877. On the lower Yukon, up, at least, to Anvik, the largest of these salmon run during the few days just preceding and following the breaking up of the ice and thence on to the end of the season they decrease gradually in size and quality. * * * At Anvik they begin running about the 12th of June and the season is virtually over by the middle of July. I was told that one example was taken at Anvik that weighed 140 pounds and that they sometimes weigh a third more than that.

Mr. Nelson does not regard this information as reliable. Mr. V. L. Derby in a letter dated January 19, 1907, reports that "a few king salmon rounded Point Barrow and entered the lagoons at Pargneck, the shooting station, in the spring of 1906. The natives caught a few in the fall of 1905 and summer of 1906."

One was seen by us at the cannery at Wrangell July 13, among many hundred humpbacks. A few were seen in the Taku Inlet cannery July 14. Two (1 male and 1 female) were examined at Pyramid Harbor, July 15. The male was 28 inches long and weighed 8 pounds; the female was 40.5 inches long and weighed 28 pounds.

A female seen at the Dundas Bay cannery July 24 was 34 inches long and weighed 17 pounds. The eggs of this fish were very immature. King salmon weighing 35 to 40 pounds were caught in sea-otter nets off Montague Island in December, 1894, and January, 1895.

Mr. Rutter saw one at Karluk that was 50 inches long and weighed 60.5 pounds. A female 2 feet 9 inches long, weighing 13 pounds and nearly ripe, was seined at Karluk August 4. Mr. A. B. Alexander saw one in 1888 in Nushagak that weighed 85 pounds. On July 18, 1900, Mr. Kutchin saw one at Kasilof which weighed 77 pounds.

Dr. Tarleton H. Bean says in "The Alaskan Salmon and Their Allies:"

> Individuals weighing over 100 pounds are on record. At St. Paul, Kodiak, Mr. B. G. McIntyre weighed one which registered 87.5 pounds without its vicera, and the entire fish must have exceeded 100 pounds. Capt. William Kohl has recently told me that he once obtained reliable information in Cook Inlet of a salmon weighing about 140 pounds, and individuals of equal size are reported in the Yukon.

Mr. John N. Cobb has a record of one weighing 77 and two others each of 75 pounds, taken by trolling near Ketchikan in 1905, and one of 47 pounds taken at Juneau in 1906. He gives also the following information regarding fish from Bristol Bay:

WEIGHT AND MEASUREMENTS OF 51 KING SALMON EXAMINED AT THREE BRISTOL BAY LOCALITIES IN 1906.

Locality and date.	Number examined.	Sex.	Length. Maximum.	Length. Minimum.	Length. Average.	Weight. Maximum.	Weight. Minimum.	Weight. Average.	Total number examined.	Average length.	Average weight.
			Inches.	*Inches.*	*Inches.*	*Lbs.*	*Lbs.*	*Pounds.*		*Inches.*	*Pounds.*
Koggiung (July 12)	18	♂	43	33.00	39.722	34	14.0	25.516	46	39.260	25.369
	28	♀	45	26.50	38.598	39	7.5	25.285			
Nushagak River (July 19)	2	♂	38	34.00	36.000	21	14.0	17.500	2	36.000	17.500
Wood River (July 19)	3	♂	34	29.75	31.666	15	10.0	12.333	3	31.666	12.333

Bean (1882) records this salmon from Kasilof River, Cook Inlet, and from the Yukon.

Gilbert says (1895) that at Departure Bay, May 10–13, 1890, young individuals were feeding on the herring (*C. pallasii*) and a number were taken on the trolling line. He says further:

> At Unalaska, May 24-27, 1890, the run had hardly begun, though a few individuals were seen. A small pond near the stream which flows into the head of Captains Harbor was full of young salmon of this species, from 2 to 5 inches long, which took the fly greedily. June 3, at the mounth of the Nushagak River, Bristol Bay, an occasional individual was taken. A small run had come into the river a short time before our visit. On June 16 they were running abundantly at Unalaska, but they were not seen on later visits at this point or at Port Möller. It is worthy of note that their period of greatest abundance coincided in time with that of the herring, and their approach to the coast may be determined by the movements of the latter. Their annual appearance in large numbers in Monterey Bay, California, seems to be dependent on the run of anchovies.

The following notes have been furnished by Mr. John N. Cobb:

> Considerable numbers are taken on hand-lines bated with herring on the herring grounds on the northern side of Kuiu Island. It is said that young king salmon 10 to 12 inches long can be taken in October on hand-lines from the wharves at Killisnoo. The Indians take large numbers of small kings in Florence Bay. A few are taken in gill-nets (9.5 inch mesh) at Orca, where they are packed with the red salmon. A few are obtained each year in the Copper River delta, where the run begins about May 6.
>
> King salmon are found in many of the rivers of Alaska during the breeding season, being most abundant, so far as known, in the Unuk, Stikine, Taku, Nushagak, Kvichak, and Ugashik. The rest of the year they are found scattered pretty much all over the straits, sounds, and bays of Southeast Alaska,

and it is possible they might be found in other portions of Alaska at this season were they to be fished for. At this time they are feeding upon the herring, and, in Southeast Alaska, are especially abundant in the vicinity of Point Comano on Cleveland Peninsula, and in Seymour Canal, Taku Inlet, and Gastineau Channel. It is said that there was a run of king salmon in Snug Harbor, Tenakee Inlet, in the fall of 1905 and the spring of 1906, which was the first seen there for several years.

The season of 1905 witnessed the inception of a new branch of the salmon industry. About the middle of January king salmon were observed in the vicinity of Ketchikan, but it was not until January 23 that the first fish was brought to that place. News of a large run of fish having spread, there were soon a number of whites and Indians out in canoes catching the kings, which they located by watching the gulls, which would gather over the herring schools upon which the kings were feeding. As the herring were in shoal water, nets could be used in but few places, so trolling lines were brought into use. At first herring bait was employed, but it was soon discovered that a nickel trolling spoon would answer the purpose just as well. The vicinity of Point Comano and Point Stewart seemed to be favorite resorts for the fish, but they were to be found almost everywhere within a radius of 50 miles from Ketchikan. Several firms in Ketchikan early saw the possibilities of the business and soon had out steamers and launches collecting the fish from the fishing boats. Upon reaching Ketchikan they were packed in ice and shipped to Puget Sound ports. The fish averaged 25 pounds in weight. One was caught which weighed 77 pounds, while several were brought in which weighed 75 pounds each. About 25 per cent of the catch consisted of white-meated fish and 75 per cent of red-meated. For the former the fishermen were paid 25 cents each and for the latter 50 cents each. During the run, which lasted until May 18th, 271,644 pounds, valued at $15,600, were shipped. A considerable quantity was also cured by the Indians for their own use, while some were consumed locally by the whites.

The Ketchikan dealers state that the king salmon were very delicate and would not stand such handling as a red salmon will, and at first many of them had to be classed as second-grade fish on account of being bruised in killing by the Indians.

For years the Indians have been catching kings in winter for their own consumption. In 1905 the run was unusually large. It was much smaller in 1906, in the vicinity of Ketchikan, at least.

The preparation of mild-cured king salmon in Alaska has been carried on for some years. Up to the year 1906 only spawning fish were so treated, but the big run in the neighborhood of Ketchikan during the winter of 1905 attracted the attention of Puget Sound salters, and this year there were a number of plants in operation, some of which handled the feeding fish. In May and June the Juneau and Douglas dealers paid 75 cents each for all red-meated kings weighing over 17 pounds, 35 cents for all under 17 pounds, and 20 cents for white-meated kings of any weight. These dealers estimated that there were about 7 white-meated kings to every 100 red-meated fish. The largest king handled at Juneau weighed 47 pounds, while by far the greater part ran over 17 pounds in weight. Tierces holding 800 pounds were used and about 50 fish were required to fill a tierce. In curing, the head was taken off and the entrails removed. The fish was then split down the middle and the backbone taken out, thus leaving the fish in two halves. After the blood vessels were scraped out the fish were put into ice water for about thirty minutes and then salted down in the tierces with fine (dairy) salt.

The number of king salmon required to the case (of 48 one-pound cans) varies somewhat, as shown by the following figures: Orca, 4.2 fish to the case; Dundas Bay, 4.5; Pyramid Harbor, 3.5; Taku, 2.8; Nushagak, 3; Kvichak River, 2.7; Naknek River, 5; Yes Bay, 2.5; Cook Inlet, 3.5; Kenai, 2.7; Kasilof, 3; Odiak, 4.5. Of the places mentioned, the largest fish appear to come to the Yes Bay cannery and the smallest to Naknek River. Too much credence, however, should not be given these figures.

A very curious and interesting fact has been noticed regarding the color of the flesh of the king salmon. In some individuals the flesh is red, in others white. In Columbia River fish it is usually that rich red or salmon color which is so highly prized, although even in that river a certain percentage of the fish are white-meated. In Alaska apparently a somewhat larger percentage are white-meated. Of 3,232 cases put up at Pyramid Harbor, 977 were white; of 4,375 cases at Taku, 1,225 were white or pink. These figures indicate that about 42 per cent of Alaska king salmon are white-meated. This, of course, keeps the commercial value of the fish from being what it otherwise would be.

As already stated, the king salmon of Southeast Alaska are taken chiefly by trolling. Considerable numbers, however, are taken in gillnets at Port Snettisham, Wrangell Narrows, Point Highfield, Pyramid Harbor, Taku, Kenai, Kasilof, and elsewhere. The gillnets used in this fishery are usually 9.5-inch mesh. In some places it is 8.5, 9, or 9.25. The nets vary from 50 to 250 fathoms long and from 20 to 30 meshes deep.

The king salmon is the least abundant of the five species found in Alaska. Commercially it ranks as the least important. The catch of 1906 was 267,387 fish, and the pack 60,357 cases valued at about $223,286.

The future development of the king salmon fishery in Alaska will be in the large streams to the northward, particularly in those tributary to Bering Sea. It is probable that methods of conducting the fishery will be developed which will, in spite of the short season and other unfavorable conditions, permit large catches to be made in such streams as the Yukon and Kuskokwim.

THE BEGINNING AND ENDING OF COMMERCIAL FISHING FOR KING SALMON AT VARIOUS FISHING STATIONS IN ALASKA, 1904–1906.

NOTE.—The fact that the name of a river is given does not mean that fishing is carried on in the river itself; in many instances the fishing station is in the vicinity of the stream and its name has been employed in order more clearly to identify the stream. The dates given do not necessarily mean the beginning and ending of the run for each stream, as the fish may have been running for sometime before the cannery men were able to fish the stream and the pack may have been obtained and fishing stopped before the end of the run.

Waters.	1904.		1905.		1906.	
	Fishing began—	Fishing ended—	Fishing began—	Fishing ended—	Fishing began—	Fishing ended—
Bering Sea.						
Nushagak Bay[a]	June 8	Aug. 3	June 1	July 1	June 5	Aug. 3
Igushik River	June 12	June 27	June 15	June 20		
Kvichak River[b]	June 21	Aug. 3	June 13	Aug. 2	June 20	Aug. 7
Naknek River[c]	June 22	Aug. 2	June 14	July 30	June 21	July 31
Ugashik River[d]	June 26	Aug. 1	June 13	July 28	June 18	Do.
Ugaguk River					June 16	July 25
Nelsons Lagoon					June 15	July 24
Central Alaska.						
Chignik Lagoon and River	June 8	Aug. 8				
Kodiak Island: Karluk[e]	June 6	July 15	June 6	July 14	June 2	July 7
Cook Inlet (Kasilof)[f]	May 27	Aug. 4	May 25	July 13	June 3	Aug. 13
Prince William Sound:						
Chenega Stream	July 2	July 30				
Billys Hole	do	do				
Miners River	do	do				
Eyak Lake and River					May 12	July 30
Copper River[g]			May 15	July 25	do	Do.
Pete Dahl Slough	May 6	July 15			do	Do.
Gus Wilson Slough					do	July 12
Castle Slough					do	Do.
Peter Walhalla Slough	May 6	June 30			do	Do.
G. Stevens Slough	do	do			do	Do.
Martin River	do	July 10			do	Do.
Little River					do	July 1
Italian Flats	May 6	July 25			do	July 12
Big Bar	do	do				
Snag Point					May 12	June 30
Chilkat River	June 1	July 10			July 1	July 28
Southeast Alaska.						
Icy Strait: Pleasant Island					June 26	Sept. 18
Lynn Canal	June 15	Sept. 15			do	Sept. 22
Chilkoot Inlet and River	June 20	Sept. 17				
Chilkat Inlet and River[h]	June 4	July 20	June 27	July 15	June 29	Sept. 22
Tee Harbor	May 20	Sept. 7				
Lena Cove			May 15	Sept. 15		
Auk Bay	May 6	Sept. 7	May 8	June 20		
Point Louise			May 15	Sept. 15		
Chatham Strait: Funter Bay, Admiralty Island	June 1	Sept. 15			June 20	July 15
Stephens Passage	May 14	Sept. 7	May 8	June 30		
Taku Inlet[i]	May 6	do	do	do		
Port Snettisham	July 4	Aug. 4	do	do		
Seymour Canal					July —	Oct. —
Wrangell Strait: Petersburg Creek, Mitkof Island			June 29	Sept. 16		
Stikine River[j]			May 17	July 27	May 26	June 19
Clarence Strait:						
Eagle Creek, Prince of Wales Island	July 5	Sept. 4			June 22	July 22
Ernest Sound—						
Point Warde, Cleveland Peninsula					June 27	July 28
Anan Creek, Cleveland Peninsula					July 2	July 23
Behm Canal—Yes Bay, Cleveland Peninsula			Apr. 13	Apr. 18		
Tongass Narrows—Ketchikan Creek, Revillagigedo Island[k]						

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[a] 1900, June 12 to July 22.
[b] 1900, June 23 to July 25.
[c] 1900, June 18 to July 25.
[d] 1900, June 18 to June 29
[e] 1900, June 5 to June 28.
[f] 1896, May 25 to June 25; 1897, May 26 to July 27; 1900, June 1 to July 10.
[g] 1890, May 5 to June 30; 1891, April 27 to June 30; 1892, cannery closed; 1893, May 2 to June 30; 1894, May 11 to June 30; 1895, May 15 to June 29; 1896, May 15 to June 30; 1897, May 10 to June 30.
[h] 1898, June 10 to July 10.
[i] 1896, May 25 to June 25; 1897, May 28 to June 28; 1900, May 8 to June 26.
[j] 1896, May 15 to June 22; 1897, May 15 to June 22; 1900, March 14 to June 28.
[k] 1892, July 15 to September 1.

30. Oncorhynchus kisutch (Walbaum). *Silver Salmon; Coho.* (Pl. XXXI and XXXII.)

The coho is common in Southeast Alaska and as far north at least as Karluk. It also occurs in Bristol Bay and probably in the Yukon. Nelson (1887) records it from St. Michael and Norton Sound, where he says the run in the streams begins about September 1. The first examples seen by us were caught June 19, by trolling in the outer harbor at Nanaimo. After that date the fish was seen at most of the canneries visited, being in greatest abundance, however, at those canneries visited late in August.

Dr. Gilbert, speaking of this species at Unalaska, says:

> Two young were seined at Unalaska, June 16, 1890, the smaller of which, 190 mm. long, shows very conspicuous parr-marks. These have disappeared in the larger specimen, 225 mm. long, which has also assumed more the proportions and appearance of the adult. In this specimen the spots are more distinct than in the adult, being large, well defined, and close-set on head, back and dorsal fin, and the caudal fin is very indistinctly marked, the faint spots being confined to the outer rays of both lobes. It is a male with the testes so well developed as to make it very probable that it would have sought the spawning-grounds within a few months. Three smaller specimens were taken in Herendeen Bay July 5. The smallest of these is 145 mm., the largest 185 mm. long. The distal half of the dorsal fin is black with the exception of the last two rays, which are entirely white.

Mr. Rutter found the young common in sloughs along the edge of Karluk River near its source May 22. Forty-one specimens taken on that date were each about 1.25 inches long, 16 others were 2.8 to 6 inches long. He gives the life color of a 6-inch specimen taken from the ocean June 18 as follows:

> Back olive brown thickly spotted with black; dorsal dusky except that the last ray is pale; tip of caudal dusky; the dusky portion greater on lobes; a specimen photographed to-day has distinct parr-marks; pectoral yellowish; caudal also yellowish by transmitted light; iris somewhat golden.

Under normal conditions the coho is the last salmon to appear, the run in Southeast Alaska usually not beginning until after all the other species have gone.

The run of cohos at Nushagak is usually not large during the canning season, but is said to be larger later in the year. In Nelson Lagoon (Bristol Bay) there is a run in August, too late to be utilized by the canneries. There is said to be a good run in Bear River (Bristol Bay) in July and August. The species seems to be fairly abundant among the Aleutian Islands, as evidenced by the fact that, in September, 1906, a Japanese vessel secured 1,500 fish about Attu Island; and it is stated that other vessels secured about the same number earlier in the season. At Alitak (Kodiak Island) the run begins about the latter part of August; it is chiefly in Silver Salmon Bay. The species occurs also at Yakutat. At Dundas Bay the first coho seen in 1906 appeared on July 1.

In size, the coho ranks third among the Pacific salmon. The following table gives the lengths and weights of 556 individuals, representing 11 different localities. The longest fish was 33 inches in total length, the shortest, 20.75 inches; the heaviest weighed 15 pounds, the lightest, 3 pounds. The average length of the males (235) was 28.29 inches, of the females (321), 27.53 inches. The average weight of the males was 9.03 pounds, of the females, 8.86 pounds.

LENGTHS AND WEIGHTS OF COHO SALMON.

Locality.	Number examined.	Sex.	Length.			Weight.			Total number examined.	Average length.	Average weight.
			Maximum.	Minimum.	Average.	Maximum.	Minimum.	Average.			
			Inches.	*Inches.*	*Inches.*	*Lbs.*	*Lbs.*	*Lbs.*		*Inches.*	*Lbs.*
Nichols Bay	26	♂	31.75	26.50	29.14	14.00	6.00	10.71	104	28.50	9.84
	78	♀	30.75	24.50	28.29	12.25	5.00	9.55			
Hessa Inlet	44	♂	33.00	26.00	29.59	14.00	7.50	10.97	100	28.69	10.34
	56	♀	30.50	20.75	27.99	12.00	4.00	9.85			
Home Bay, Klawak	35	♂	30.50	25.50	28.64	15.00	6.00	9.95	100	27.95	9.14
	65	♀	29.75	24.25	27.58	11.50	4.00	8.70			
Shipley Bay	54	♂	31.00	24.25	27.84	13.00	6.00	8.35	105	27.34	8.02
	51	♀	29.75	22.75	26.82	11.00	5.00	7.66			
Hunter Bay (Nutkwa Stream)	49	♂	30.50	24.00	27.67	12.00	5.00	9.11	100	27.10	8.71
	51	♀	29.50	23.25	26.54	11.50	5.00	8.31			
Yakutat	16	♂	30.00	23.00	26.56	12.00	4.00	7.88	22	26.81	8.09
	6	♀	29.00	24.00	27.50	11.00	6.00	8.67			
Pillar Bay	4	♂	33.00	27.00	29.75	11.75	8.25	9.62	11	28.82	8.75
	7	♀	29.00	26.75	27.58	8.25	7.00	7.58			
Nanaimo	2	♂	22.50	21.50	22.00	4.25	3.00	3.63	2	....	....
Karta Bay	2	♂	26.50	26.50	26.50	7.00	7.00	7.00	2	....	....
Dundas Bay	2	♂	....	....	27.17	....	....	8.00	8	27.13	8.13
	6	♀	....	....	27.25	....	....	8.50			
Chignik Bay	1	♂	....	....	29.63	....	....	12.50	2	29.06	11.25
	1	♀	....	....	28.50	....	....	10.00			

As a food fish the coho occupies a high rank. The flesh is less firm than that of the red salmon and the scales fall off more readily when the fish is handled; and the flesh is rather pale in color, not possessing the deep red hue of the red salmon and the choice chinook. The flavor of the flesh, however, is excellent, and only the pale color keeps it from ranking with the best. The canners usually pay to the fishermen the same price for the cohos that they pay for reds.

The coho is canned as "coho" or "medium red." The first of these names is entirely proper and appropriate, as is also the second, unless possibly it might be objected to as suggesting that the contents of the can is really the red or sockeye salmon of a color somewhat less red than usual. To the trade, however, these two names have come to have a definite and well-understood meaning. They are not, so far as we are informed, ever applied to any other species, and we regard them as wholly satisfactory trade names.

Commercially the coho is at present, next to the king, the least important of the 5 species found in Alaska. In 1906 the total catch was 984,804 fish, yielding 113,054 cases, valued at $392,251.

THE BEGINNING AND ENDING OF COMMERCIAL FISHING FOR COHO SALMON AT VARIOUS FISHING STATIONS IN ALASKA, 1900 AND 1904–1906.

NOTE.—The fact that the name of a river is given does not necessarily mean that fishing is carried on in the river itself; in many instances the fishing station is in the vicinity of the stream and its name has been used in order to locate the stream more clearly. The dates given do not necessarily mean the beginning and ending of the run for each stream, as the fish may have been running for some time before the cannery men were able to fish the stream and the pack may have been obtained and fishing stopped before the end of the season.

Waters.	1900.		1904.		1905.		1906.	
	Fishing began—	Fishing ended—	Fishing began—	Fishing ended—	Fishing began—	Fishing ended—	Fishing began—	Fishing ended—
Bering Sea.								
Nushagak Bay	June 21	July 24	June 25	Aug. 4	July 10	July 30	July 11	Aug. 4
Kvichak River	July 20	July 25	July 27	Aug. 3	June 17	July 28		
Naknek River							(a)	(a)
Ugaguk River							(a)	(a)
Ugagshik River					June 15	July 26		
Central Alaska.								
Chignik Lagoon and River	Aug. 3	Aug. 12						
Kodiak Island:								
Karluk	Aug. 25	Sept. 21	Aug. 21	Sept. 30	July 22	Sept. 25	Aug. 13	Sept. 12
Alitak Bay			Aug. 27	Sept. 3	Aug. 22	Aug. 27	Aug. 7	Sept. 2
Cook Inlet (Kasilof)	July 1	Aug. 10	May 27	Aug. 4			July 16	Aug. 13
Prince William Sound [b]								
Southeast Alaska.								
Yakutat Bay			Aug. 29	Aug. 29				
Situk River			...do...	Oct. 2	Aug. 27	Sept. 27	Aug. 22	Sept. 25
Ankau River			Aug. 30	Sept. 29	Aug. 29	Sept. 29	...do...	Do.
Ankau Slough			Aug. 27	Sept. 12	Aug. 21	Sept. 14	Aug. 14	Sept. 15
Ahrnklin River			Aug. 30	Oct. 3	Aug. 27	Sept. 27	Sept. 1	Sept. 13
Ahrnklin Slough					Sept. 14	Sept. 26		
Lituya Bay					Aug. 16	Aug. 16		
Surge Bay, Yakobi Island					July 25	Aug. 20	July 25	Aug. 11
Takanis Bay, Yakobi Island					July 29	Aug. 27	Aug. 11	Do.
Cape Edward, off Chicagof Island					Aug. 20	Aug. 24		
Portlock Harbor, Chicagof Island					Aug. 10	Aug. 10	Aug. 25	Aug. 25
Cross Sound: Taylor Bay					Aug. 27	Aug. 27		
Lisianski Strait							July 31	July 31
Kochtakeine (?)					Aug. 6	Aug. 13		
Porcupine (?)					Aug. 13	Aug. 27	Sept. 3	Sept. 3
Icy Strait:								
Dundas Bay					...do...	Sept. 13	Sept. 5	Sept. 17
Glacier Bay—Bartlett Bay	Aug. 20	Sept. 30			Aug. 26	Sept. 11	Aug. 28	Sept. 19
Pleasant Island			June 15	Oct. 8	June 22	Sept. 9	July 6	Sept. 13
Excursion Inlet							Sept. 8	Sept. 20
Port Frederick, Chichagof Island							Sept. 5	Sept. 5
Lynn Canal			June 25	Oct. 8			July 27	Sept. 23
Chilkoot Inlet and River			June 20	Sept. 17				
Chilkat Inlet and River			Aug. 23	Sept. 23	Aug. 20	Sept. 15	June 29	Sept. 22
Eagle River					July 15	...do...	July 4	Sept. 5
Lena Cove					July 1	Sept. 15		
Point Louise					...do...	...do...		
Auk Bay					Aug. 15	...do...		

[a] Run too late.

[b] 1891, August 4 to September 14.

THE BEGINNING AND ENDING OF COMMERCIAL FISHING FOR COHO SALMON AT VARIOUS FISHING STATIONS IN ALASKA, 1900 AND 1904–1906—Continued.

Waters.	1900.		1904.		1905.		1906.	
	Fishing began—	Fishing ended—	Fishing began—	Fishing ended—	Fishing began—	Fishing ended—	Fishing began—	Fishing ended—
Southeast Alaska—Continued.								
Chatham Strait:								
Funter Bay, Admiralty Island			June 1	Sept. 15	July 11	Sept. 16	July 4	Sept. 5
Freshwater Bay, Chichagof Island			July —	Aug. —				
Basket Bay, Chichagof Island			July —	Aug. —				
Bay of Pillars					Aug. 30	Oct. 1		
North Arm, Kuiu Island			Aug. 28	Sept. 15			Aug. 15	Sept. 20
South Arm, Kuiu Island	Aug. 15	Nov. —					do	Sept. 15
Tebenkof Bay—Kuiu Bay, Kuiu Island					Aug. 30	Sept. 30	do	Sept. 20
Stephens Passage			July 25	Sept. 7	Aug. 15	Sept. 15		
Taku Inlet	Aug. 1	Oct. 1			do	do		
Port Snettisham					do	do		
Seymour Canal							July —	Sept. —
Frederick Sound:								
Saginaw Bay, Kuiu Island					Aug. 23	Oct. 2		
Hamilton Bay, Kupreanof Island			Aug. 29	Sept. 3				
Portage Bay, Kupreanof Island			Aug. 8	Aug. 8				
Cleveland Passage							July 17	Aug. 27
Keku Strait					Aug. 23	Oct. 2		
Wrangell Strait:								
Petersburg Creek, Mitkof Island			July 29	Sept. 16	Aug. 5	Sept. 9	Aug. 1	Sept. 13
Blind Point, Mitkof Island					July 1	Oct. 15	Aug. 14	Sept. 10
Duncan Canal, Kupreanof Island			July 28	Sept. 17	Aug. 8	Sept. 9	July 27	Aug. 25
Sea Otter Sound:								
Tuxekan, Prince of Wales Island							Aug. 25	Sept. 1
Tokheni Stream, Kosciusco Island			Sept. 1	Sept. 11	Sept. 15	Sept. 15		
Iphigenia Bay: Warm Chuck, Heceta Island					Aug. 29	Sept. 14	Aug. 21	Sept. 3
Tonowek Bay:								
Sarkar, Prince of Wales Island	Aug. 14	Sept. 16	July 15	Sept. 24	July 10	Sept. 16	Aug. 28	Sept. 1
Nahakay, Prince of Wales Island							Aug. 29	Sept. 5
Gulf of Esquibel: Shineha Creek, Prince of Wales Island (?)							Sept. 19	Sept. 19
San Alberti Bay:								
Stayne Chuck, Prince of Wales Island (?)			Sept. 1	Oct. 8	Aug. 17	Sept. 13		
Klawak Inlet, Prince of Wales Island	Aug. 14	Sept. 24	Aug. 26	do	Aug. 24	Sept. 14	Sept. 1	Sept. 26
Soda Harbor, Prince of Wales Island			Sept. 6	Sept. 24			do	Do.
Big Harbor, Prince of Wales Island			Aug. 31	Sept. 23	Aug. 22	Sept. 14	do	Do.
Cordova Bay:								
Sukkwan, Prince of Wales Island			Aug. 27	Sept. 27			do	Do.
Hetta, Prince of Wales Island			Aug. 27	Sept. 24	Aug. 29	Sept. 14		
Nutkeva Inlet, Prince of Wales Island			Sept. 1	Sept. 21				
Hunter Bay, Prince of Wales Island			Aug. 1	Aug. 25	Aug. 17	Sept. 11		
Sumner Strait:								
Shipley Bay, Kosciusko Island			Aug. 13	Sept. 1			Aug. 21	Sept. 3
Seclusion Harbor, Kuiu Island			Sept. 12	Sept. 18	Sept. 1	Sept. 8		
Rocky Pass, Kuiu Island (?)			Aug. 28	Sept. 15	Aug. 23	Oct. 2	Aug. 10	Sept. 30
Point Barrie Stream, Kupreanof Island			Aug. 3	Aug. 24	Aug. 5	Aug. 28	July 30	Aug. 23
Totem Bay, Kupreanof Island			Aug. 12	Sept. 6	Aug. 25	Aug. 25	Aug. 17	Aug. 24
Red Bay, Prince of Wales Island			Aug. 25	Aug. 28	Aug. 7	Sept. 7	Aug. 4	Aug. 31
Blind Slough, Mitkof Island			Sept. 1	Sept. 1				
Stikine River					July 29	Sept. 6	July 30	Aug. 4
Zimovia Strait:								
Olive Bay, Etolin Island					Aug. 25	Sept. 5	Aug. 10	Aug. 30
Thoms (old village) Stream, Wrangell Island	Aug. 5	Sept. 12					Aug. 1	Sept. 3
Clarence Strait:								
Salmon Bay, Prince of Wales Island			July 29	Sept. 15	July 1	Sept. 8	July 1	Sept. 4
Eagle Creek, Prince of Wales Island			Aug. 18	Sept. 4	do	Sept. 27	do	Sept. 6
Whale Passage, Prince of Wales Island					do	Sept. 8	do	Sept. 10
Lake Bay, Prince of Wales Island			Aug. 25	Sept. 15	June 25	Sept. 1	do	Sept. 4
Coffman Cove, Prince of Wales Island							do	Do.
Valdemar Bay, Prince of Wales Island			Sept. 9	Sept. 9				
Steamer Bay, Prince of Wales Island			Aug. 12	Aug. 21				
Rocky Bay, Prince of Wales Island			Aug. 1	Sept. 10	Aug. 7	Sept. 8	July 1	Do.
Ratz Harbor, Prince of Wales Island					June 25	Sept. 1	do	Do.
Ernest Sound—								
Union Bay, Cleveland Peninsula			Aug. 8	Aug. 8	Sept. 2	Sept. 4	July 17	Aug. 14
Vixen Point, Cleveland Peninsula							Aug. 8	Aug. 26
Etolin Cove, Etolin Island							Aug. 25	Aug. 30
Menefee Inlet, Etolin Island							July 25	Aug. 5
Santa Anna Bay, Cleveland Peninsula							Aug. 27	Aug. 27
Anan Creek, Cleveland Peninsula					July 1	Sept. 1	July 1	Sept. 4
Doris Bay (?)							Sept. 6	Sept. 8
Middle Arm (?)							Sept. 11	Sept. 16
Midway Cove (?)							Aug. 14	Aug. 30
Sunny Point (?)							Sept. 10	Sept. 16

THE BEGINNING AND ENDING OF COMMERCIAL FISHING FOR COHO SALMON AT VARIOUS FISHING STATIONS IN ALASKA, 1900 AND 1904–1906—Continued.

Waters.	1900.		1904.		1905.		1906.	
	Fishing began—	Fishing ended—	Fishing began—	Fishing ended—	Fishing began—	Fishing ended—	Fishing began—	Fishing ended—
Southeast Alaska—Continued.								
Clarence Strait—Continued.								
Meyers Stream, Cleveland Peninsula							Aug. 1	Sept. 3
Thorne Bay, Prince of Wales Island							do	Sept. 4
Kasaan Bay—								
Karta Bay, Prince of Wales Island	Aug. 30	Sept. 20					Aug. 15	Sept. 3
Skowl Arm, Prince of Wales Island							Aug. 4	Sept. 6
Behm Canal—								
Naha Stream, Revillagigedo Island			July 15	Sept. 1				
Yes Bay, Cleveland Peninsula	Aug. 11	Sept. 17					Aug. 20	Sept. 15
Checats Stream	July 26	Sept. 7						
Smeaton Bay			Sept. 3	Sept. 3				
Tongass Narrows—Ward Cove, Revillagigedo Island	July 13	Sept. 7					July 23	Sept. 6
Cholmondeley Sound					Aug. 5	Nov. 7	July 30	Oct. 30
Dora Bay, Prince of Wales Island					Aug. 3	Sept. 5	July 31	Sept. 15
Peter Johnson Stream (Dolomi), Prince of Wales Island	July 28	Sept. 1	July 16	Sept. 15	July 19	Sept. 8	June 30	Sept. 14
Moira Sound—								
North Arm, Prince of Wales Island					Aug. 19	Sept. 12	July 13	Sept. 8
Shalclair, Prince of Wales Island					Aug. 25	Sept. 8		
Browns, Prince of Wales Island					Aug. 12	do		
South Arm—								
Keegan stream, Prince of Wales Island			Aug. 4	Sept. 2	Aug. 11	Sept. 9	July 11	Sept. 6
Old Johnson Stream, Prince of Wales Island							July 13	Sept. 3
Nichols Passage—								
Gravina Bay, Gravina Island			Aug. 22	Sept. 1				
Bostwick Inlet, Gravina Island			Sept. 3	Sept. 7				
Hemlock Island, off Annette Island			Aug. 26	Sept. 9				
Tain, Annette Island			Aug. 4	Sept. 2	Aug. 3	Sept. 2	Aug. 8	Sept. 15
Tamgas Harbor, Annette Island	Sept. 4	Sept. 4	Aug. 9	Sept. 13	Aug. 12	Sept. 1	July 24	Aug. 29
Nadyaeer, Annette Island							Sept. 7	Sept. 8
Revillagigedo Channel:								
George Inlet, Revillagigedo Island	July 25	Sept. 6	July 7	Sept. 5			July 6	Sept. 1
Hassler Harbor, Annette Island			Aug. 28	Sept. 3				
Nancy Haines (?)							Sept. 14	Sept. 19
Duke Island			Aug. 10	Sept. 10	Aug. 7	Sept. 1	Aug. 8	Aug. 31
Kah Shakes Cove							July 24	Aug. 23
Foggy Bay			Sept. 1	Sept. 3				

31. Oncorhynchus nerka (Walbaum) *Red Salmon; Redfish; Sockeye; Blueback Salmon.*

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This species also is of wide distribution. On the American coast its range extends from southern Oregon to Bering Sea. The most southern stream from which it has been reported is the Sacramento, from which it was recorded by Dr. Jordan in 1880, but it is not known whether he actually examined a specimen. In 1899 Mr. F. M. Chamberlain, of the Bureau of Fisheries, identified a single specimen which he obtained at Baird as belonging to this species. During the very extended study of the salmon of the Sacramento River by Mr. Rutter, no examples were seen by him. It is certain, therefore, that if this species of salmon occurs in the Sacramento River at all it is very rare.

The fishermen on the coast of Humboldt County, Cal., obtain a salmon which they call blueback or sockeye. The statistical report shows that the catch in 1899 was 21,600 pounds, and that of 1904 was 272,840 pounds. Whether these fish are really the blueback, or red, salmon is questionable. Eel River, Humboldt County, is the stream on which this fishery is located, and it has never been known as a blueback salmon stream. It is not known to have any lakes in its headwaters to which this species could resort for spawning purposes. Whether the blueback salmon occurs in it or not, therefore, must be regarded as a subject for future investigation. The same may be said regarding the Klamath River.

The Columbia is the most southern river in which this species is known to run in any numbers. Formerly, and up perhaps to about 1890, there was a considerable run in the Columbia, and important spawning beds existed in the headwaters of that river, particularly at Wallowa Lake in Oregon and the Payette lakes and the Sawtooth lakes in Idaho. A few bluebacks are seen at each of these lakes each season now, but they are only a pitiful remnant of the great schools that formerly came to them at spawning time. North of the Columbia the next blueback salmon stream is the Quiniault on the coast of

Washington. At one time this was said to be an excellent blueback stream, able to supply to the Indians of the Quiniault Reservation a large part of their food. It is said that there is still a small run here. There is also a small run in Ozette Lake, just south of Cape Flattery.

Of the streams tributary to Puget Sound the only ones in which the sockeye, as this salmon is usually called in that region, is known to run are the Lake Washington system of lakes, the Skagit and, possibly, the Snohomish, the Stillaguamish, and the Nooksak. The only one of these, however, in which there is any considerable run is the Skagit, which the fish ascend to reach Baker Lake for spawning purposes. Doubtless the greatest of all the sockeye streams is the Fraser River. Ever since the early days of the salmon canning industry on our western coast the Fraser has been famous for the enormous runs of sockeyes which ascend that great river to the lakes at its headwaters.

Going northward from the Fraser we find several streams in British Columbia in which the sockeyes run in considerable numbers. The principal of these are the Skeena, Rivers Inlet, Naas, Lowe Inlet, Dean Channel, Namu Harbor, Bella Coola, Smith Inlet, Alert Bay, and Alberni Canal. It is by far the most abundant and most important salmon in British Columbia waters. In Alaska, where it is known as the redfish, red salmon, or sockeye, it is abundant and runs in great numbers in all suitable streams. In Southeast Alaska the following are the most important red salmon streams: Naha, Boca de Quadra, Yes Bay, Nowiskay, Keegan, Peter Johnson, Klawak, Hessa, Hetta, Hunter Bay, Chilkat, Taku, Chilkoot, Karta, Thorne Bay, Stikine, etc.; in Central Alaska, Alsek, Copper, Afognak, Karluk, Alitak, Chignik, Knik, and Sushitna; in the Bristol Bay region, the Ugashik, Naknek, Kvichak, Nushagak, and Wood. The red salmon is said to ascend the Yukon, at least to Caribou Crossing, but we have seen no specimens from that river and do not know whether there is any considerable run in it. Nor do we know whether the species occurs in the Kuskokwim, the Kobuk, or any stream north of the Nushagak. On the Asiatic side the red salmon is known to occur at Bering Island and in all suitable streams south to Japan.

This species of salmon is peculiar in that it rarely or never ascends a stream that has not one or more lakes at its headwaters. Its spawning beds are invariably in small streams tributary to lakes or, rarely, in the lakes themselves. No red salmon is known to have spawned in any stream not connected with a lake. Some have been seen occasionally in the lower part of a stream which had no lake in its course, but it is believed such individuals soon discovered their mistake and promptly returned downstream in search of the proper water. The only instances of this kind which have come under the personal observation of the senior author are the following: In August, 1903, while at Sitka, he saw a red salmon speared by an Indian in Indian River near the bridge, which, however, is only a short distance above the mouth of the stream; it is understood there is no lake in this stream. The other case is that of Gold Fork, a tributary of Payette River, Idaho. While at Payette Lake in September, 1894, he learned, on what he believes to be entirely trustworthy evidence, that red salmon are sometimes seen in the mouth of that stream, but that they soon return and ascend the main fork of the Payette, which comes from Big Payette Lake, in whose inlet there were formerly important spawning beds. The origin and significance of this peculiar habit are not known. The problem is one worthy of investigation.

The red salmon is the neatest and most symmetrical of the salmon. In the sea, or when fresh run, it is clear sky blue on the back and upper part of the sides, shading to clean silvery white below and on belly. Soon after entering the river for the purpose of spawning, the color of the head changes to a rich olive, the back and sides to crimson and finally to a dark blood red, richest in the males, and the belly a dirty white. Some of the scales become dark edged and the middle of the side shows the darkest red, but unevenly. At the same time the flesh becomes spongy, the scales embedded, the back somewhat humped, and the jaws hooked and otherwise distorted.

The run of the red salmon in Alaska begins usually in June; in Bering Sea and Central Alaska early in June or even in May, while in Southeast Alaska it is one to three weeks later. The earliest recorded date we have is May 6, for Eyak and the Copper River region. In Bering Sea the run is usually over by the end of July, in Central Alaska and Prince William Sound by the end of August, and in Southeast Alaska by the 10th of September or earlier. The period of the run of red salmon in different parts of Alaska, so far as the records show it, is given in the table on page 254.

THE BEGINNING AND ENDING OF COMMERCIAL FISHING FOR RED SALMON AT VARIOUS FISHING STATIONS IN ALASKA, 1900 AND 1904-1906.

NOTE.—The fact that the name of a river is given does not necessarily mean that fishing is carried on in the river itself; in many instances the fishing station is in the vicinity of the stream and its name has been used in order to locate the station more clearly. The dates given do not necessarily mean the beginning and ending of the run for each stream, as the fish may have been running for some time before the cannerymen were able to fish the stream and the pack may have been secured and fishing stopped before the end of the run.

Waters.	1900.		1904.		1905.		1906.	
	Fishing began—	Fishing ended—	Fishing began—	Fishing ended—	Fishing began—	Fishing ended—	Fishing began—	Fishing ended—
Bering Sea.								
Nushagak Bay	June 20	July 25	June 8	Aug. 4	June 5	July 28	June 5	Aug. 4
Igushik River			June 28	July 28	June 21	July 14	June 16	July 20
Wood River			July 1	July 31			June 22	July 27
Kvichak River	June 23	Aug. 1	June 21	Aug. 5	June 13	Aug. 2	June 20	Aug. 7
Naknek River	June 18	July 28	June 22	Aug. 2	June 14	July 30	June 21	July 31
Ugaguk River	July 1	July 25	June 25	July 25	June 23	July 25	June 15	July 25
Ugashik River	June 21	July 29	June 26	Aug. 1	June 13	July 28	June 18	July 31
Nelsons Lagoon							June 15	July 24
Central Alaska.								
Chignik Lagoon and River	June 6	Aug. 19	June 8	Aug. 14	June 10	Aug. 13	June 7	Aug. 14
Kodiak Island:								
Karluk	June 4	Sept. 21	June 6	Sept. 30	June 5	Sept. 25	June 15	Sept. 13
Red River			June 1	July 27	May 29	July 17	June 7	July 15
Little River	June 8	Aug. 13	May 30	July 24	May 27	July 19	June 8	July 7
Alitak Bay			June 15	Sept. 3	June 18	Aug. 21	July 3	Sept. 4
Koshuak			May 30	June 17				
Uganik River			June 5	Aug. 3	June 12	July 5	June 16	July 17
Waterfalls					July 7	Aug. 8	July 13	Aug. 27
South End			Aug. 2	Aug. 10				
Cook Inlet (Kasilof)	June —	Aug. 10	May 27	Aug. 4	May 28	July 13	June 3	Aug. 13
Prince William Sound:[a]								
Chenega Stream			July 2	July 30			July 20	Aug. 20
Billys Hole			do	do			July —	Aug. —
Miners River			do	do			July —	Aug. —
Ishman River					July 27	Aug. 2		
Eyak Lake and River			May 6	July 18	June 10	July 28	May 12	July 30
Mountain Slough							do	Do.
Copper River					May 15	July 25	do	June 30
Pete Dahl Slough			May 6	July 3			do	Do.
Gus Wilson Slough							do	July 12
Castle Slough			May 6	July 12				
Peter Walhalla Slough			do	June 30				
G. Stevens Slough			do	do				
Martin River			do	July 10	May 15	July 25	May 12	Do.
Little River							do	Aug. 1
Italian Flats			May 6	July 25			do	July 12
Big Bar			do	do				
Snag Point							May 12	June 30
Chilkat River			June 1	July 10			July 1	July 28
Southeast Alaska.								
Yakutat Bay							June 12	June 26
Situk River			June 15	July 30	June 7	Aug. 9	June 1	Aug. 8
Ankau River			July 5	Aug. 2	June 20	July 26	June 20	July 31
Ankau Slough			July 10	Aug. 1	June 12	Aug. 4	June 18	Aug. 9
Ahrnklin River			July 6	Aug. 17	June 21	July 5	June 4	Do.
Lituya Bay					Aug. 16	Aug. 16		
Surge Bay, Yakobi Island			June 22	Aug. 24	June 20	Aug. 29	June 26	Aug. 11
Takanis Bay, Yakobi Island					do	do	do	July 22
Cape Edward, off Chicagof Island			June 22	Aug. 24	do	July 20	July 4	July 11
Portlock Harbor, Chicagof Island							Aug. 25	Aug. 25
Redoubt Bay, Baranof Island			June 22	Aug. 24				
Necker Bay, Baranof Island							June 15	July 25
Redfish Bay, Baranof Island			July 20	Aug. 20	July 15	Aug. 10	do	Aug. 10
Cross Sound:								
Cape Spencer							June 30	July 2
Taylor Bay			Aug. 12	Aug. 24	June 21	Aug. 27	July 25	Aug. 28
Lisianski Strait					July 28	Aug. 3	do	July 31
James Bay (?)					July 27	July 29		
Kochtakeine (?)					June 20	Aug. 13	June 26	Aug. 1
Porcupine (?)					June 25		July 9	July 9
Icy Strait:								
Dundas Bay			June 22	Aug. 25	June 20	Aug. 3	June 26	July 30
Glacier Bay—Bartlett Bay	June 25	Aug. 7			June 21	July 30	June 28	July 31
Pleasant Island			June 15	Oct. 8	June 22	Sept. 15	July 1	Aug. 23
Lynn Canal			June 25	do			June 29	Sept. 22
Chilkoot Inlet and River	July 12	Aug. 22	July 10	Sept. 17	July 15	Aug. 15	do	Sept. 10
Chilkat Inlet and River	July 25	Sept. 1	June 24	Sept. 23	June 27	Sept. 15		

[a] 1891, June 16 to July 13.

THE BEGINNING AND ENDING OF COMMERCIAL FISHING FOR RED SALMON AT VARIOUS FISHING STATIONS IN ALASKA, 1900 AND 1904–1906—Continued.

Waters.	1900.		1904.		1905.		1906.	
	Fishing began—	Fishing ended—	Fishing began—	Fishing ended—	Fishing began—	Fishing ended—	Fishing began—	Fishing ended—
Southeast Alaska—Continued.								
Lynn Canal—Continued.								
Eagle River					July 1	Sept. 15	June 21	Sept. 5
Tee Harbor			July 1	Sept. 7				
Lena Cove					July 1	Sept. 15		
Point Louise					do.	do.		
Auk Bay			June 25	Sept. 7	do.	Aug. 25		
Chatham Strait:								
Funter Bay, Admiralty Island			June 1	Sept. 15	June 19	Sept. 16	June 21	Do.
Basket Bay, Chichagof Island			June 22	Aug. 25				
Sitkoh Bay, Chichagof Island			do.	do.				
Peril Strait			July —	Aug. —				
Red Bluff Bay, Baranof Island					July 10	Aug. 10	June 20	Aug. 30
Gut Bay, Baranof Island			July 1	Aug. 25	June 30	do.	do.	Do.
Bay of Pillars—South Arm, Kuiu Island	June 25	Aug. 7	July 9	Aug. 10	July 10	Aug. 20	June 25	Do.
Tebenkof Bay:								
Aleck Stream, Kuiu Island			June 19	July 25	June 15	Aug. 1	June 10	July 20
Kuiu Bay, Kuiu Island			June 25	Sept. 7	July 1	Aug. 25		
Stephens Passage:								
Taku Inlet	June 20	Aug. 12	July 1	do.	do.	do.		
Port Snettisham	July 9	July 27	July 4	Aug. 4	do.	do.		
Frederick Sound:								
Portage Bay, Kupreanof Island			Sept. 1	Sept. 1				
Cleveland Passage							July 17	Aug. 27
Wrangell Strait: Petersburg Creek, Mitkof Island			June 29	Aug. 4	June 26	Aug. 9	July 3	Aug. 4
Duncan Canal, Kupreanof Island			July 5	Aug. 26	June 27	Aug. 17	July 2	Aug. 11
Sea Otter Sound: Tokhini Stream, Kosciusko Island			July 12	Aug. 1	July 12	July 30		
Iphigenia Bay: Warm Chuck, Heceta Island			July 9	Sept. 1	July 8	Aug. 31	July 14	Aug. 22
Tonowek Bay:								
Sarkar, Prince of Wales Island	June 19	Aug 4	June 7	Sept. 20	June 13	Aug. 22	June 15	Aug. 4
Nahakay, Prince of Wales Island					July 6	Aug. 17		
San Alberti Bay:								
Klawak Inlet, Prince of Wales Island	June 17	Aug. 24	June 14	Aug. 25	June 14	Aug. 23	June 20	Aug. 29
Soda Harbor, Prince of Wales Island					Aug. 29	Sept. 11		
Cordova Bay:								
Hetta, Prince of Wales Island	June 17	Aug. 23	June 14	Sept. 10	June 14	Sept. 9	June 20	Sept. 3
Klakas Inlet, Prince of Wales Island			July 13	do.	July 12	Aug. 20		
Hunter Bay, Prince of Wales Island			do.	do.	July 10	do.	July 3	Aug. 13
Hessa Inlet, Prince of Wales Island			Aug. 15	do.	July 20	do.		
Nichols Bay, Prince of Wales Island			July 13	do.	July 10	do.	July 13	Aug. 5
Sumner Strait:								
Shipley Bay, Kosciusko Island	June 27	Aug. 14	July 4	Aug. 25			July 8	July 31
Calder and Elcopdam Bay, Prince of Wales Island			July 28	Sept. 28				
Point Barrie Stream, Kupreanof Island			June 26	Aug. 20	June 27	Aug. 25	July 1	Aug. 23
Red Bay, Prince of Wales Island	July 5	Aug. 5	June 27	Aug. 19	do.	Aug. 22	June 29	Aug. 31
Totem Bay, Prince of Wales Island			Aug. 28	Aug. 28				
Blind Slough, Mitkof Island			Sept. 1	Sept. 1				
Stikine River					June 22	Aug. 24	July 4	Aug. 4
Zimovia Strait: Thoms (old village) Stream, Wrangell Island	June 26	Aug. 1					June 20	July 31
Clarence Strait:								
Salmon Bay, Prince of Wales Island	June 18	July 27	June 27	Aug. 15	June 25	Sept. 1	June 15	Sept. 4
Eagle Creek, Prince of Wales Island			July 5	Aug. 30	June 30	do.	June 22	Do.
Whale Passage, Prince of Wales Island					July 1	do.		
Lake Bay, Prince of Wales Island			July 1	Aug. 15	do.	do.	July 1	Sept. 4
Valdemar Bay, Prince of Wales Island			Aug. 12	Aug. 14				
Rocky Bay, Etolin Island			July 27	Aug. 27	July 19	Aug. 18	July 1	Do.
Ratz Harbor, Prince of Wales Island							July 30	Aug. 11
Ernest Sound—								
Union Bay, Cleveland Peninsula			Sept. 8	Sept. 8				
Point Warde, Cleveland Peninsula							July 27	July 28
Anan Creek, Cleveland Peninsula					July 1	Sept. 1	July 2	July 23
Meyers Stream, Cleveland Peninsula							July 17	Sept. 3
Thorne Bay, Prince of Wales Island							Aug. 1	Sept. 4
Kasaan Bay—								
Karta Bay, Prince of Wales Island	June 19	Aug. 20	July 9	July 17			June 13	Aug. 17
Twelvemile Arm, Kina Stream, Prince of Wales Island							June 18	Do.
Skowl Arm, Prince of Wales Island					Aug. —	Sept. —	do.	Sept. 5
Behm Canal—								
Helm Bay, Cleveland Passage							July 23	July 29
Naha Stream, Revillagigedo Island			July 1	Sept. 21				
Yes Bay, Cleveland Peninsula	July 14	Sept. 17	July 16	Aug. 19			July 20	Aug. 20
Chickamin River			Aug. 15	Aug. 22				
Checats stream	July 13	Aug. 15	July 11	Aug. 17			July 17	Aug. 3

THE BEGINNING AND ENDING OF COMMERCIAL FISHING FOR RED SALMON AT VARIOUS FISHING STATIONS IN ALASKA, 1900 AND 1904–1906—Continued.

Waters.	1900.		1904.		1905.		1906.	
	Fishing began—	Fishing ended—	Fishing began—	Fishing ended—	Fishing began—	Fishing ended—	Fishing began—	Fishing ended—
Southeast Alaska—Continued.								
Clarence Strait—Continued.								
Tongass Narrows—Ward Cove, Revillagigedo Island	...do...	Aug. 23	Aug. 5	Aug. 11			July 23	Sept. 6
Cholmondeley Sound			July 26	Aug. 7	Aug. 5	Sept. 1	July 30	Sept. 5
Dora Bay, Prince of Wales Island			July 9	Aug. 20	July 11	...do...	July 11	Sept. 6
Peter Johnson Stream (Dolomi), Prince of Wales Island	July 7	Sept. 1	July 13	Sept. 13	...do...	Sept. 2	June 30	Do.
Moira Sound—								
North Arm, Prince of Wales Island			July 14	Aug. 22	...do...	Sept. 7	July 13	Sept. 8
Shalclair, Prince of Wales Island					July 19	Aug. 24		
Browns, Prince of Wales Island					July 29	Aug. 16		
South Arm—								
Kegan Stream, Prince of Wales Island			July 12	Sept. 2	July 11	Sept. 7	July 11	Sept. 6
Nowiskay Stream, Prince of Wales Island			...do...	...do...				
Old Johnson Stream, Prince of Wales Island			July 13	...do...			July 13	Sept. 3
Nichols Passage—								
Bostwick Inlet, Gravina Island			Sept. 3	Sept. 7				
Tain, Annette Island			July 15	Sept. 9	July 11	Aug. 28	July 11	Aug. 31
Tamgas Harbor, Annette Island	July 7	Sept. 1	July 16	Aug. 31	...do...	...do...	July 10	Aug. 21
Revillagigedo Channel:								
George Inlet, Revillagigedo Island	July 8	Aug. 1	July 7	Sept. 5			July 6	Sept. 1
Carroll Inlet, Revillagigedo Island			Aug. 14	Aug. 21				
Thorne Arm, Revillagigedo Island							Aug. 24	Aug. 24
Hassler Harbor, Annette Island			Aug. 28	Sept. 3				
Duke Island			July 16	Aug. 26	July 12	Sept. 1	...do...	Aug. 31
Boca de Quadra	July 12	Aug. 31	July 9	Aug. 27			...do...	Aug. 26
Kah Shakes Cove	July 10	Aug. 15					July 24	Aug. 23

Although the red salmon run is somewhat later than that of the king, the two species are sometimes found together. Writing of his observations in 1890, Dr. Gilbert says:

> It appeared constantly associated with the king salmon. It was taken by trolling in Departure Bay, Vancouver Island, May 10 to 13; was seined in small numbers at Unalaska May 24 to 27, and was abundant there June 16. It had not begun to run at Nushagak June 3, but the young with parr marks still evident, ranging in size from 95 to 115 mm., were very abundant. These were doubtless descending the rivers to the sea and were probably about 20 months old. On July 5, young averaging slightly larger than the above were taken in salt water at Herendeen Bay, Alaskan Peninsula. These ranged from 120 to 130 mm. in total length. The color is deeper and less silvery than in the Nushagak examples and the parr marks have almost wholly disappeared.

The beginning of the run in any given stream is fairly constant, the variation being within narrow limits. The duration of the run is for a shorter period in the northern region than it is farther south. In Bristol Bay and Central Alaska it lasts only six weeks or less, while in Southeast Alaska it continues about two months.

The number of red salmon running in any given stream is constant from year to year only within rather wide limits. It is believed by most fishermen and canners that every fourth year any given stream is apt to have a larger run than in any of the three other years of the series. In a general way this belief seems to be borne out by statistics; when specific cases are examined, however, the rule appears of doubtful application. For example, the catch of red salmon in the Ugashik River for the last six years has been as follows: 769,002 fish in 1901; 1,640,973 in 1902; 1,703,536 in 1903; 564,492 in 1904; 432,779 in 1905; and 152,140 in 1906. As the run was large in 1902 it should have been large in 1906, but it was the smallest ever known. Judging from the run of 1903, that for 1907 ought to be a large one. Information regarding it will be awaited with interest.

In Nushagak Bay and Wood River the run was very large in 1905, four traps in Wood River furnishing over 800,000 fish, while many thousands more were turned loose. In 1906 these same traps produced only about 200,000 fish, and three additional traps operated in the same region produced about 100,000 more, giving a total for Wood River for 1906 of about 300,000 as against more than 800,000 for 1905.

Although the price of red salmon was higher in 1906 than in 1905, and every effort was made to secure a large pack in the Bristol Bay region, the total number of red salmon cases fell 120,000 short of the pack of 1905. There are, however, so many factors entering into the conditions which determine the size of the pack in Bristol Bay that it is not safe to make any positive statement as to whether the catch has reached its limit. As has been said by Jordan and Evermann, "A wise administration of the fisheries will permit the taking of the largest number of fish compatible with the maintenance of the supply, and will permit their capture by the cheapest method which is not wasteful." But when it becomes apparent that the run is decreasing and that the fishery is permanently impaired, the catch should in some way be limited and ample opportunity be given to rehabilitate the fishery.

In size the red salmon ranks third among the five Pacific species of the genus. During the recent investigations a total of 1,390 red salmon from as many different places as possible were measured and weighed. The results, which are given in detail in the accompanying table, may be summarized as follows: For the males—Maximum length, 32 inches; minimum, 15.5; average, 27.81. Maximum weight, 11 pounds; minimum, 1.75; average, 7.43. For the females—Maximum length, 30 inches; minimum, 20.25; average, 24.87. Maximum weight, 11 pounds; minimum, 2; average, 5.78. For both males and females—Average length, 26.36 inches; average weight, 6.57 pounds. It is therefore safe to say that the red salmon of Alaska averages a trifle more than 6.5 pounds in weight.

At Chignik Bay is occasionally taken a small red salmon locally known as the "Arctic salmon" which is considerably smaller than the average for that region. On August 9, 1903, the senior author found and examined at the two canneries on Chignik Bay 13 examples of this fish, 12 of the 13 being males. The maximum and minimum lengths of the males were 19.38 and 15.86 inches, and the average 17.35; extreme weight 2.71 and 1.71 pounds, average 2.2 pounds. The single female was 22.63 inches long and weighed 4.63 pounds. These fish are not a different species, but evidently merely precocious individuals such as are found among the chinook salmon on the Columbia River, where mature small males are not infrequent. The fact that all but one of these so-called "Arctic salmon" were males shows them to be dwarfs of the same character. The opinion of local fishermen that this small salmon is peculiar to Chignik Bay is not borne out by the facts, as similar small fish were seen at Alitak, Karluk, and other places.

In various small lakes in Idaho, Oregon, Washington, and British Columbia is found a dwarf form of the Alaska red salmon known variously as small redfish, little redfish, Kennerly's salmon, or walla. The list of lakes in which this fish is known to occur is as follows: Alturas, Pettit, Redfish and Big Payette lakes in Idaho; Wallowa Lake in Oregon; Washington, Sammamish, Ozette, and possibly, American and Chelan lakes in Washington; Chiloweyuck, Nicola, François, Fraser, Okanagan, and Kootenai lakes in British Columbia. And recently during the investigations conducted by Mr. Chamberlain in the vicinity of Loring, Alaska, 2 or 3 examples of the little redfish were found in Patching Lake. This is a small lake in the Naha basin. In its outlet is a falls which fish from the sea can not ascend. Redfish fry from the Fortmann Hatchery had been planted in the lake, and it can not, therefore, be definitely known whether this specimen was one of the planted fish, dwarfed by the unfavorable environment, or one of a native race or form long landlocked in the lake.

The so-called little redfish does not appear to differ structurally from the larger form. It is mature, however, both males and females, at a length of a foot or less, and, like the ordinary red salmon, spawns only once, after which it dies. Recent observations by the senior author, and consideration of all the known facts concerning these little redfish, convince him that they do not come up from the sea, but are landlocked in the lakes in which they occur.

Next to the humpback the red is the most abundant salmon in Alaska—indeed, it is probable that, during the last 20 years, it has been no less numerous than the humpback. Commercially it is by far the most valuable salmon in Alaska. The total catch of 1906 was 19,536,761 fish, representing 1,540,856 cases, valued at $5,720,291. The total number of salmon of all species handled in Alaska in 1906 was 31,756,335, representing 2,341,587 cases, valued at $8,152,665. From these figures it is seen that the red salmon constitute more than 61 per cent of the catch, 65 per cent of the pack, and 70 per cent of the value. And in every year previous to 1906 the red salmon constituted even a larger proportion of the entire catch, as the utilization of the cheaper species has developed only within recent years.

LENGTHS AND WEIGHTS OF RED SALMON.

Locality and date.	Fish examined.	Sex.	Length.			Weight.			Total fish examined.	Average length.	Average weight.
			Maximum.	Minimum.	Average.	Maximum.	Minimum.	Average.			
			Inches.	*Inches.*	*Inches.*	*Lbs.*	*Lbs.*	*Pounds.*		*Inches.*	*Pounds.*
Nushagak	93	♂	30.00	22.75	27.63	11.00	4.00	7.793	121	27.127	7.466
	28	♀	29.00	21.25	25.45	85.00	4.00	6.383			
Koggiung	121	♂	31.00	25.00	28.589	10.00	5.00	7.59	201	27.470	7.225
	80	♀	29.00	24.5	25.779	9.00	5.00	6.673			
Wood River	76	♂	29.00	22.5	26.569	9.5	4.00	6.740	100	25.97	6.25
	24	♀	26.25	20.5	24.072	6.5	2.00	4.697			
Ugaguk River	74	♂	32.00	26.00	28.629	9.00	6.00	7.949	156	27.85	7.636
	82	♀	30.00	25.75	27.167	9.75	5.00	7.414			
Naknek River	52	♂	30.5	26.5	28.58	9.25	6.5	8.168	100	27.74	7.63
	48	♀	29.00	23.00	26.828	11.00	5.5	7.046			
Ugashik River	76	♂	30.50	26.00	28.605	10.00	6.00	7.99	128	27.771	7.361
	52	♀	29.00	24.5	26.55	7.5	4.00	6.44			
Chignik, Aug. 9	80	♂	30.35	20.5	30.18	10.5	3.5	8.48	154	26.83	7.51
	74	♀	29.25	21.5	23.054	8.5	4.4	6.47			
Karluk, Aug. 15	79	♂	27.25	15.5	25.19	7.87	1.75	5.68	200	24.397	5.08
	121	♀	27.00	20.25	23.88	6.5	2.5	4.685			
Pyramid Harbor, July 15	17	♂	28.75	24.5	26.97	8.00	6.00	7.11	31	26.773	7.056
	14	♀	28.25	24.25	26.535	7.75	6.00	6.98			
Klawak, Aug. 25	11	♂	28.75	19.5	25.12	7.00	3.00	5.09	83	24.96	4.09
	72	♀	26.25	20.75	23.38	6.5	3.00	3.944			
Hetta Bay, Aug. 9	13	♂	26.5	22.5	22.94	7.00	4.00	5.48	102	23.60	4.825
	89	♀	26.00	21.00	23.705	6.00	3.00	4.73			
Karta Bay, July 10	11	♂	29.00	26.5	27.545	8.5	6.00	7.21	14	27.32	7.000
	3	♀	27.00	26.00	26.5	6.5	6.00	6.33			

32. **Salmo clarkii** (Richardson). *Alaska Cutthroat Trout.* (Pl. xv, fig. 1, and pl. xxxvii.)

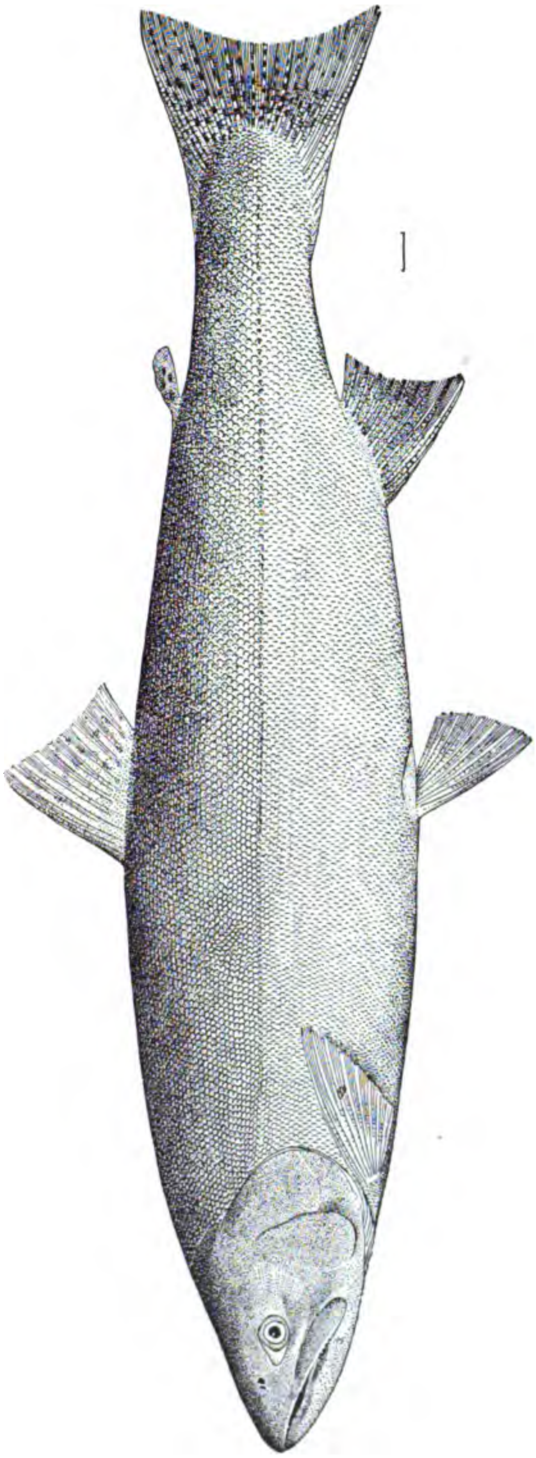
In 1881 Dr. Bean recorded this trout as *Salmo purpuratus* from Sitka, St. Paul (Kodiak Island), and "northern Alaska." Not until the investigations were made on which this report is based had any other specimens been recorded from Alaska or any Alaskan specimens come into the hands of any ichthyologist. Doubtless anglers and others knew of the presence in Alaska of a species of cutthroat trout. Indeed, officers and members of the civilian staff of the Fisheries steamer *Albatross* state that they have found cutthroat trout at various places in Southeast Alaska and that specimens were forwarded to the Bureau. These, however, seem to have been lost en route, as they were never received at Washington.

During the recent investigations cutthroat trout were obtained at the following places: San Mateo Lake near Union Bay, Vancouver Island (June 22); lake at Courtney, Union Bay (June 22); Karta Bay stream (July 11); Pablof Falls, Freshwater Bay (July 25); Silver Bay Creek near Sitka (July 29); Klawak Creek (August 26), and Naha stream near Loring (August 30). Other specimens were obtained in the vicinity of Loring in 1903, and again in 1904 and 1905, and numerous fine specimens were collected in Lake McDonald and vicinity by Mr. J. S. Burcham in 1905.

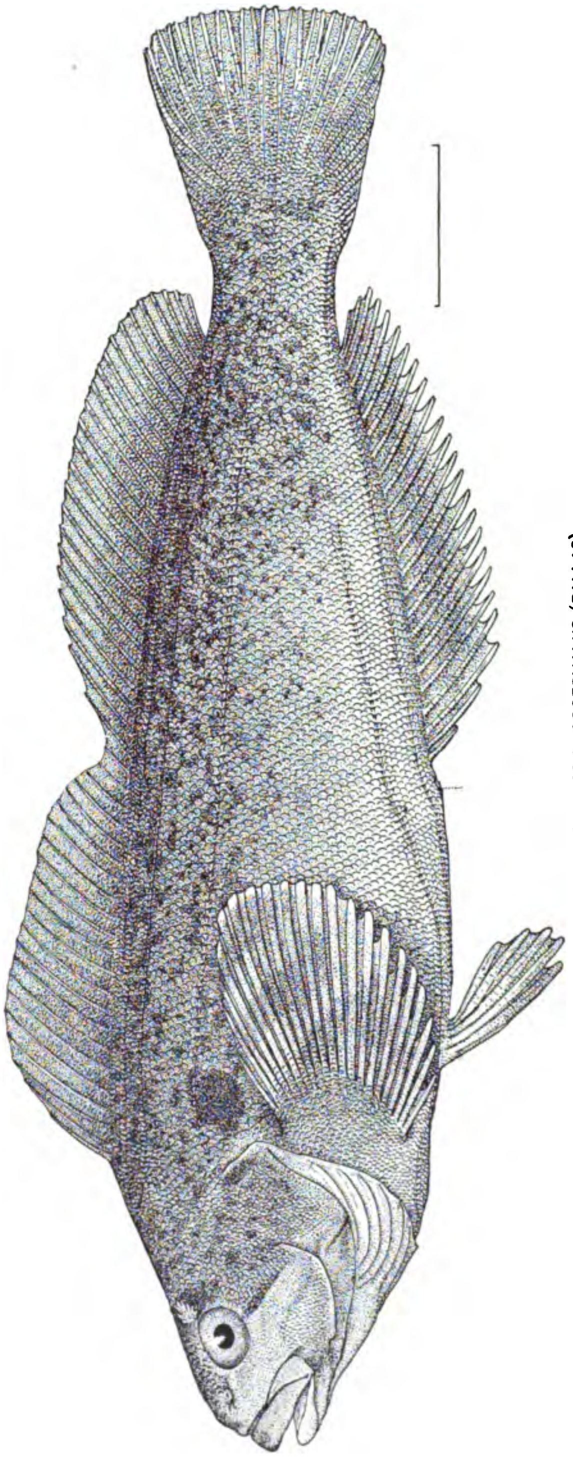
In all of these places the cutthroat trout was fairly common, apparently most abundant at Loring, Lake McDonald, and Klawak. It doubtless occurs in many other streams and lakes in Southeast Alaska. Just how far north it extends has not been definitely determined. We did not find it north of Sitka. We have a photograph, taken by Mr. R. W. Stone, of the U. S. Geological Survey, and furnished by Mr. Frank Hess, also of the Survey, showing a number of trout and salmon caught September 25, 1904, at Katatla, Controller Bay, in a stream about one-fourth of a mile from the beach. Among the fish shown is one that is evidently a cutthroat or a rainbow trout.

The following notes were taken on specimens from various places:

No. 02809, taken with fly by Dr. Evermann in Lake San Mateo, Vancouver Island, a female 14.5 inches long, weight one pound, not nearly ready to spawn. Color in life, top of head, back and side to base of pectoral thickly covered with small, somewhat stellate black spots, those on head and nape roundish; cheek with about 7 black spots—2 or 3 on upper part of opercle; dorsal and caudal with numerous oblong black spots; 3 spots on adipose dorsal; anal with black spots less numerous than on caudal and dorsal; ventrals pale rosy, the outer ray with a series of small black spots; pectorals pale rosy on inner rays, the outer dusky; cheek and opercle with rosy; some rosy on side of lower jaw; belly dusky, slightly rosy; throat with a broad, rich red dash on each side; tip of lower jaw black; side silvery with bronze wash; the black spots on back and side about evenly distributed, those on caudal peduncle largest. When first taken out of the water the whole fish except belly appeared quite dark.



1. SALMO CLARKII (RICHARDSON).



2. HEXAGRAMMOS LAGOCEPHALUS (PALLAS).

Another specimen (no. 02810) from the same place, an immature male 9.5 inches long, was similar in life color to the one above described, except that there were no spots on ventrals, and cheeks and opercles were more spotted, there being 3 or 4 spots on preopercle and the same number on opercle.

An example (no. 02811), 11 inches long, from Courtney Lake, was a male somewhat more mature than no. 02810, and its color was similar, except that the spots on side of head were less numerous, being but 4 on upper part of cheek, 2 on preopercle and 4 on upper part of opercle. On no. 02810 the spots extended farther down; scales about 165.

Another example (no. 02812), 6 inches long, from same place, is profusely spotted like the others and shows traces of parr marks. The red on throat present, but not distinct.

A fine 13-inch example, taken July 11 by Lieutenant Mitchell in Karta Bay Stream a short distance above the mouth, when fresh was dark olive on back, side silvery, belly white; back and upper four-fifths of side profusely covered with small irregular black spots; side of head with a few small round black spots; cheek and middle of side with pale rosy wash; throat with light red wash; fins all dark; dorsal and caudal with many large black spots; anal a little paler and with fewer spots; ventrals still paler, black inside; pectoral dark, with 2 or 3 small black spots. Dorsal 10; anal 12.

A 9.5-inch specimen (no. 02944), weighing 4 ounces, caught by Dr. Evermann at Pablof Falls, July 25, was in life yellowish green on back and upper part of side; middle of side slightly rosy, belly silvery; back with close-set small roundish black spots; side with larger black spots; top of head and cheek with small round black spots; opercle somewhat rosy; throat rich red.

Another was silvery, dark, profusely spotted with black, and with the red on throat very distinct.

No. 03021, taken at Klawak, August 26, had the body and head profusely and uniformly covered with large, irregular black spots; fins all densely spotted.

Two 7.5-inch specimens (2 and 2.5 ounces each), taken by Lieutenant Mitchell and Chief Engineer Crater at Silver Bay near Sitka, had the spots confined chiefly to back and side above lateral line and head; caudal peduncle with more spots; very little red showing on throat of second, none on first; side somewhat rosy, cheek also. It may be that these are young steelheads.

We have critically examined more than 30 excellent examples of cutthroat trout from the vicinity of Yes Bay and Loring, and many other specimens from those places, Klawak, and elsewhere, in Southeast Alaska, have passed through our hands. An example 14.5 inches long from Lake McDonald may be regarded as typical: Head 4.4; depth 4.4; eye in head 6.5; snout 3.5; maxillary 1.9, reaching slightly past orbit; pectoral 1.8; least depth of caudal peduncle 2.4; scales about 146. Body robust, not greatly compressed, the caudal peduncle stout; head rather long and conic; snout rather long and pointed. Entire body covered somewhat profusely with small stellate black spots, less numerous on head, where they are more nearly round. Dorsal, anal, and caudal fins profusely spotted; pectoral with a few spots, ventrals plain; ventrals and anal slightly tipped with yellow; a bright red dash on the throat.

The Alaska cutthroat is close to the Alaska rainbow and may not be always readily distinguished from it. We believe them to be distinct species, however. The cutthroat may be distinguished by its red throat, more stellate black spots, longer head, longer maxillary, less brightly tipped ventral and anal fins, and smaller scales. The number of scales in the lateral line runs from 140 to 180, while in the rainbow it runs from 120 to 140. The cutthroat is not as large as the rainbow, the largest example seen by us being only 14.5 inches long. The numerous examples examined range in length from 6 to 14.5 inches. At Klawak local anglers stated that the cutthroat does not attain as large size as the rainbow of the same stream, and this statement was borne out by our own observations at that place; also at Loring and Lake McDonald.

The Alaska cutthroat trout ranks high as a game fish, though not equaling the rainbow. It is a much better game fish than the Dolly Varden or salmon trout. It strikes with more vim, fights more viciously, dives more deeply, ranges more widely, and is much more apt to jump; but when once out of the water it is more quiet than the Dolly Varden. It takes the fly readily, but of course the baited hook is more attractive.

Mr. A. B. Alexander and the senior writer of this report visited San Mateo Lake June 22 expressly to obtain examples of this trout. At first we rowed about over the lake some time, trying different apparently likely places with different kinds of flies and, finally, other lures. One slight strike was gotten in the upper end of the lake, but no others until we reached a small cove on the south side, where

Mr. Alexander got a fine 9.5-inch example at the surface. A little later another fine example was hooked at a depth of about 6 feet. It fought very vigorously, usually bearing down very hard, then circling about rapidly, leaping slightly, then bearing down again and circling again, and coming alongside, and finally breaking away—the penalty we paid for being without a landing net. This fish was estimated to be 19 inches long. A few minutes later another was hooked in 4 feet of water, and, though given no opportunity to play, showed itself able to make a good fight. Later each of us got one good strike, but failed to land the fish. Local anglers call these "black-speckled trout."

The examples taken at Pablof Falls had little opportunity to show their fighting power on account of the very turbulent water and the vast number of salmon and Dolly Varden trout which crowded upon them.

Mr. Crater reported that the three which he took in Naha Stream were very satisfactory as game fish.

As a food-fish the Alaska cutthroat is delicious—far superior to the Dolly Varden and not inferior to the Alaska rainbow. The flesh is firm, flaky, and rich in oil, with a most agreeable flavor.

This trout inhabits both streams and lakes. At Loring it occurs in both. At Yes Bay the finest examples were obtained from the stream between Lake McDonald and the bay. Those from Klawak came from the stream below the lake.

In Alaska this species is usually known as the black-speckled trout, blackspotted trout, or cutthroat.

33. **Salmo gairdneri** (Richardson). *Steelhead Trout.* (Pl. xxxviii.)

The first records of steelhead trout in Alaska are those by Dr. Bean from Sitka and from St. Paul. Kodiak Island (1881), and Mountain Lake near Mount Tongass (1883).

The species seems to be widely distributed in Alaska, although definite records are not numerous. Captain Moser states that it occurs at all seasons at Afognak Island, but in greatest numbers during the coho run. It is believed to winter in the lakes and to descend to the sea soon after the streams open in the spring. He further says that steelheads were first noticed in the vicinity of Pyramid Harbor in 1900 and that they have not been noted at Chekats. Several specimens were secured at Chilkoot Inlet, August 20 to September 8, and an occasional example is seen at Point Highfield.

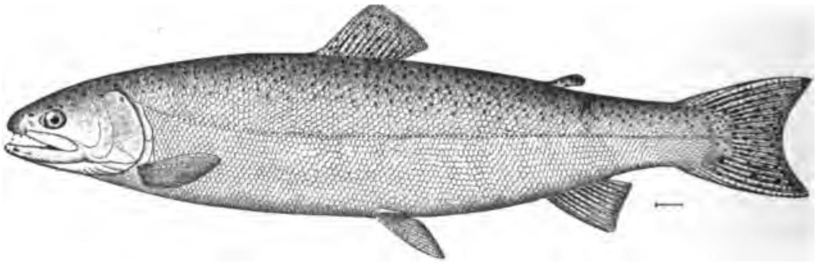


FIG. 10.—Salmo gairdneri (Richardson).

On March 26, 1903, two steelheads—the first of the spring run—were caught in a gill net at the Fortmann Hatchery. On April 26 two others with shrunken stomachs and well-developed eggs and milt were taken at the same place. On May 8 steelheads were spawning in Naha Stream below Dorr Falls. On May 10 about one dozen were observed to be spawning in Steelhead Creek near Loring. The temperature of the stream was between 38° and 39°; the surface temperature of Naha Bay was 40° to 43°. About all these fish had disappeared by May 17. On May 23 about 30 steelheads (mostly spent females) were taken in a seine in Naha Stream above Dorr Falls. At one haul of the seine in a hole below the falls about the same number were taken, among them several ripe males and females. On July 8 several fish believed to be steelheads were seen in the river above the lake. July 26 many steelhead fry were seen dying on the sandbars in Karta River, where they were entrapped by the receding waters. The same occurrence was observed in Flume Creek near Loring, where, on August 12, 1904, Mr. H. C. Fassett picked up 73 steelhead fry from the margin of the pool under the dam built below the falls to supply water to the flume. Others were observed at various places in the dry bed of the stream where they had been left by receding waters. The next day 87 steelhead fry were collected under similar conditions. These fry measured 29 to 36 mm.

Two adult steelheads were taken in Hot Springs Creek, Bell Island. These with several others were in a deep pool where they had been left by falling water as they were returning from their spawning beds in the lake about a mile farther up the stream. Examples are also reported from the Pacific Cold Storage Company at Taku Harbor. On August 14 a few were seined at Karluk, where they are reported not to be common. May 26 to 30 Mr. Claudius Wallich found them spawning in the stream at the head of Lake McDonald. Quite a number were observed. On May 24 to 27, 1904, Mr. F. M. Chamberlain found them spawning in Steelhead Creek near Loring, also in Naha River above Dorr Falls. The temperature of the water in the creek was 56° to 57°, that of the river being 50°. No steelheads were noticed in a small branch of Steelhead Creek, where the temperature was 45.°

One example (no. 02813; scales about 150), 10 inches long, was caught with hook and line June 22 in Courtney Lake at Union Bay. A few examples were seen in the cannery at Point Highfield July 13 and at Taku Harbor July 14. A female 17 inches long and weighing 1 pound 10 ounces was caught at Snug Harbor August 6.

The center of abundance of the steelhead is evidently the Columbia River. Mr. F. M. Warren, sr., of Portland, reports that the run in the Columbia, Rogue, and other Oregon rivers was large in 1902 and 1903. The first spring run in 1903 was about June 20 and continued two days, the fish averaging only 7 pounds. The fish of the later run (in August) were much larger, averaging about 15 pounds. A few may be taken in the Columbia any day in the year. The largest one of which we have a definite record was caught at Corbett, on the Columbia River, by Reed Brothers. It was seen by Mr. J. N. Wisner and weighed 42 pounds. Reed Brothers state that they often get steelheads of that size.

On September 11 many steelheads were seen in Mr. Warren's cold-storage plant at Goble, on the Columbia. They were then being caught in traps near by. At this time it was difficult to tell males from females. A female examined showed the roe to be very immature, indicating that spawning would probably not have occurred before February or March.

One hundred and five examples were measured and weighed. The lengths varied from 31 to 45 inches and the weights from 10.5 to 32.5 pounds. The average length was 37.03 inches and the average weight 18.48 pounds. Several examined at Pyramid Harbor in August were 26 to 32 inches long and weighed 9.5 to 13.5 pounds. One taken at Bell Island was 33 inches long and weighed 9 pounds.

In September and October, 1897, Mr. A. B. Alexander, of this Bureau, examined a large number of steelheads at the Cascades and at Celilo, on the Columbia River. Many were seen, September 18 and 19, ascending the falls. In all 4,179 were examined; of these, 1,531 were males and 2,648 females; 476 males and 900 females were regarded as well developed and ready to spawn within a month or six weeks.

This ripening of the steelhead in the fall is probably unusual. All other observations indicate that this species is a spring spawner. In the headwaters of Salmon River, in Idaho, it spawns in early spring—usually in May and June. In Alaska, so far as known, it spawns early in the spring.

It is not always easy to distinguish the steelhead from the cutthroat or the rainbow trout; it is particularly difficult, if not impossible, to do so in the fry and fingerling stages. The adult Alaska steelhead has larger scales, a shorter head, and a smaller eye than the Alaska cutthroat; it is also less profusely covered with black spots, the tail is more nearly square, and there is no red on the throat. From the Alaska rainbow trout it may usually be distinguished by the smaller eye, somewhat smaller scales, less brilliant coloration, and relative absence of black spots except on upper part of side and on dorsal and caudal fins.

The steelhead reaches a much larger size than either the cutthroat or the rainbow. On the Columbia it is of much commercial importance. In Alaska it is a valuable food fish, though it is not abundant enough to be of as great importance as any of the species of salmon. It lends itself well to the canning process and is a nutritious and very palatable article thus prepared. It is, however, most valuable as a fresh fish, especially when distant shipments are necessary. There is no member of the salmon family which can be handled more satisfactorily in cold storage than the steelhead. Its size, trim shape, firm flesh, and superior keeping qualities fit it admirably for treatment in this way.

34. **Salmo irideus** (Gibbons). *Alaska Rainbow Trout.* (Pl. XXXIX.)

The rainbow trout has not previously been reported from Alaska, except by Bean in 1881 from Sitka, although its presence in Southeast Alaska was known to various officers of the *Albatross* and local anglers. No specimens, however, had been collected or had come into the hands of any naturalist.

It was therefore a great pleasure to us to find rainbow trout in at least two of the streams visited in 1903—the Naha Stream at Loring and Klawak River at Klawak. On August 30 Chief Engineer Crater and Paymaster McMillan caught 13 fine examples in Naha Stream, the largest about 16 inches long and weighing about 2 pounds. On August 26 Dr. Evermann took 2 good ones in Klawak Stream above the lagoon. Mr. Thompson, the storekeeper at Klawak, reported that he had recently taken in this stream a rainbow trout that was 32 inches long. Mr. H. F. Swift says that he caught one in 1878 which weighed 8 pounds. He says that he has seen several, each weighing as much as 5 pounds.

On August 3, 1901, Dr. C. St. J. Butler and Lieut. Hugh Rodman (both then of the *Albatross*) caught a number of rainbow trout in a stream flowing into Hanas Bay, Chichagof Island, Chatham Strait, near Killisnoo. Mr. J. A. Kerr, of Seattle, informs us that rainbow trout are abundant in Powell River at the upper end of Tuxada Island, where they can be taken from June until late in the fall. About the end of August 110 were caught. He says the species occurs also at Thorne Bay. Mr. Chamberlain reports them to be common in Naha Stream near Loring, where he has seen examples 2 feet long.

During the investigations at Yes Bay in 1905 Mr. Chamberlain and Mr. Burcham found the rainbow trout quite abundant, particularly in the outlet of Lake McDonald. On June 9, 1906, Mr. Sidney Paige, of the U. S. Geological Survey, forwarded to the Bureau from Knik, Alaska, three small examples of rainbow trout which had been taken in Cottonwood Creek. This stream enters Knik Arm near its head, which is at the head of Cook Inlet, in north latitude about 61° 30′. It is more than probable that the trout photographed at Katatla by Mr. Stone and already referred to in the discussion of the cutthroat trout was a rainbow.

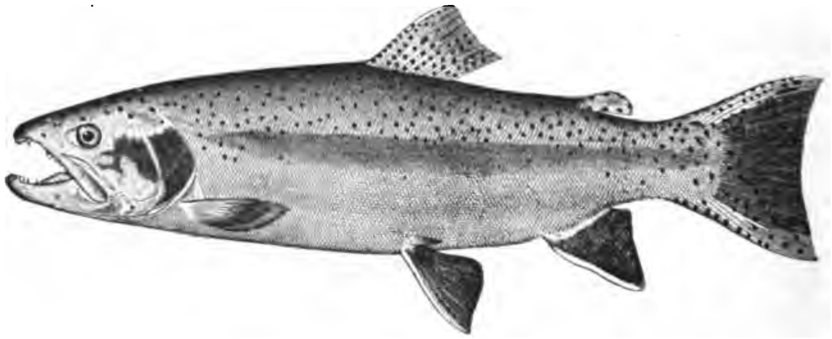


FIG. 11.—Salmo irideus (Gibbons).

The above-named localities are, therefore, the only Alaskan localities in which the rainbow trout is definitely known to occur. There are no records for the Kodiak region, the Aleutian Islands, or any waters in or north of the Alaskan Peninsula. It is quite certain, however, that further investigation will demonstrate its presence in many Alaskan streams in which it is not now known to occur.

Whether the rainbow trout of Alaska is distinct from typical *Salmo irideus* (of San Leandro Creek, California) we are not prepared to say, and we provisionally identify our specimens with that species, reserving a final decision until we have more material for comparison.

A typical example of the Alaska rainbow is no. A272 (4569), 23 inches long, from Lake McDonald, September 7, 1905. It may be described as follows:

Head 3.8 in length; depth 4.4; eye 6 in head; snout 2.9; maxillary 1.5, long and narrow, extending far beyond orbit; pectoral 1.6; body considerably compressed; head long, conic; snout long and pointed; least depth of caudal peduncle equaling length of snout; tail square, but slightly forked.

Color in alcohol: Entire body closely covered with very distinct small black spots, quite as numerous below lateral line as above; head with relatively few roundish black spots, about 20 or 25 on cheek and opercle; fins all black spotted, the spots less numerous on pectorals and ventrals; ventrals, anal, and dorsal tipped with yellowish; middle of side and cheek with a broad rosy band; no red on throat; scales 134.

An example 10 inches long from Cottonwood Creek, Knik Arm, is described as follows:

Head 4.5 in length; depth 4.3; eye 4.75 in head; snout 4.75; maxillary 1.9; scales about 120.

Body compressed; caudal peduncle deep; head rather short; maxillary extending scarcely beyond eye; teeth fairly strong on maxillary, premaxillaries, palatines, vomer, mandible, and tongue, those on vomer in two rows.

Body rather profusely covered with small black spots most numerous above lateral line; top and upper part of side of head with few small round black spots; dorsal and caudal with black spots; anal dusky, unspotted; pectorals and ventrals immaculate; side with a red stripe in life.

Two other somewhat smaller specimens possess the same characters.

An example (no. 3020) from Klawak in life had on the side a broad rich rosy band extending across the cheek and along the lateral line to base of caudal fin; no red on throat; back and side profusely spotted with small round black spots, quite uniformly distributed; caudal fin and peduncle thickly spotted.

We have examined 34 other specimens of rainbow trout from Southeast Alaska and find them to agree essentially with the specimens above described. Most of them are from Lake McDonald and vicinity, where they were collected in 1905 by Mr. Burcham. Numerous other examples were examined in 1903 at Klawak and Loring. Occasionally an individual in prime condition shows more or less red or orange on the throat, but ordinarily this mark is indistinct or wholly absent. The bright tip of the anal, ventral, and dorsal fins, however, is usually present, and this, together with the large scales, absence of red on the throat, and rosy side, will usually suffice to distinguish the Alaska rainbow from the Alaska cutthroat, though the two species are exceedingly close to each other. The rainbow attains the larger size. The largest examples seen by us were about 2 feet long. One taken at Klawak was 32 inches long, and, as already stated, Mr. H. F. Swift says he has seen several weighed 5 pounds and one that weighed 8 pounds.

The Alaska rainbow trout stands easily among the finest of game fishes. It is certainly one of the best, if not the best, in Alaska. Expert anglers fishing in Naha Stream, at Yes Bay and Klawak, pronounce it the gamest trout they have ever caught. It takes the fly readily, not with a dash or rush, but rather quietly. When once hooked, however, it fights most savagely, jumping often, and is very hard to wear out.

35. **Cristivomer namaycush** (Walbaum). *Great Lakes Trout; Lake Trout.*

The lake trout is doubtless found in all suitable waters in the Yukon basin. An individual weighing 7.25 pounds was taken in Lake Bennett, one of 11 pounds at Log Cabin, and we have seen specimens from Tagish Arm and Lake Atlin. An example was caught by Dr. Harold Heath in Summit Lake at White Pass, July 20, and one of good size was taken in Tagish Arm near Caribou Crossing July 19, by trolling, which is the usual method of capture. Townsend (1887) records this species from a lake at the head of Kobuk River, and states that it reaches a length of 3.5 feet or more. He did not find it in the Kobuk River. The fish apparently attains as large size in Alaska as in the Great Lakes, for examples weighing 30 to 40 pounds have been reported. It is of considerable commercial importance in this region, large numbers being shipped, particularly from Lake Atlin, to Dawson.

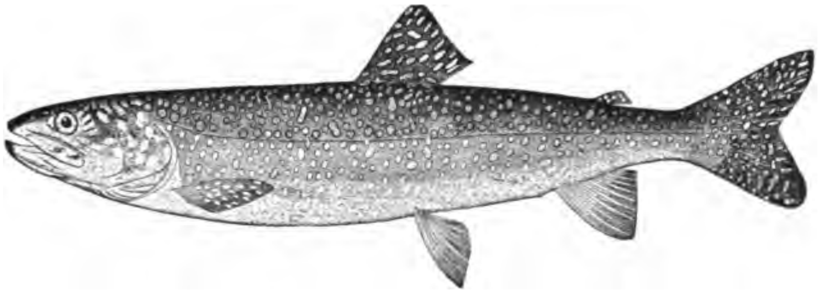


FIG. 12.—Cristivomer namaycush (Walbaum).

The lake trout can be readily distinguished from all other Alaskan Salmonidæ by the presence of a raised crest behind the head of the vomer and free from its shaft, and by the color, which is dark gray, sometimes pale, sometimes almost black, everywhere with rounded paler spots which are often reddish tinged; head usually vermiculated above; dorsal and caudal reticulate with darker.

36. Salvelinus malma (Walbaum). *Dolly Varden Trout; Salmon Trout; Western Charr.* (Pl. XL.)

This is the most abundant trout in Alaska. It swarms in every stream and lake about the islands from the Columbia to Bering Sea, and was seen by us at practically all places visited. It is particularly abundant about the canneries, where it feeds ravenously on the salmon eggs and other refuse from canning operations.

Our field notes make specific mention of the Dolly Varden trout as seen at the following places: Fort Rupert (abundant), stream at head of lake at Boca de Quadra (very abundant), Metlakahtla (seined), Karta Bay (in Alaska Packers Association trap), Cleveland Passage (seined many, 5 to 14 inches long), Taku Inlet cannery (several seen), Chilkoot cannery (very abundant), Taku, Dewey Lake near Skagway (common, but very small), Funter Bay (seined 4), Killisnoo, Sitkoh Bay, Dundas Bay (many seined and many seen in salmon trap), Pablof Falls (many seined and many caught on hook and line), Indian River at Sitka (several fine ones taken on hook and line, July 28), creek at Silver Bay near Sitka (many taken on hook July 29), Afognak Falls (abundant August 3), Karluk, Uyak, and Alitak.

On September 9, 1904, Mr. Hess, of the Geological Survey, found Dolly Varden trout 8 to 10 inches long in Big Minook Creek 10 miles from Rampart. They were abundant and were spawning. Every one examined contained parasites in the air bladder. On September 5, 1903, Mr. Hess obtained this trout in Niukluk River near Council. In October, 1905, the Bureau received 5 examples, 5.87 to 8.87 inches long, from Mr. S. P. Robins, of Rampart, who had caught them in Mynook Creek, a tributary of the Yukon.

At Afognak Falls on August 3, various parties from the *Albatross* caught many Dolly Varden trout and salmon by using a gang of 3 hooks tied together. The fish were so thick that they were readily hooked as the gang was dragged through the water.

Near Skagway is a small lake called Dewey Lake, which is some distance above sea level. It is said to be impossible now for fish to reach it from the sea, yet Dolly Varden trout occur in this lake in some numbers. They are very small, only a few inches long, and more brightly colored than those from salt water. In a small stream near Unalaska these trout are found above what is now an impassable falls. They never exceed a few inches in length, and are very richly colored. They were described as new in 1873 by Cope who called them *Salmo tudes*.

Previous Alaskan records for this trout are—Cope (1873), Captains Harbor, Unalaska. Bean (1882): Sitka; Old Sitka; Port Althrop; Chugachik Bay, and Refuge Cove, Cook Inlet; St. Paul, Kodiak Island; Humboldt Harbor and Little Koniushi Island, Shumagins; Iliuliuk and Nateekin Bay, Unalaska; Kyska Harbor; St. Michael; Unalaklik; Hotham inlet; Port Clarence; Cape Lisburne; Arctic Ocean. Gilbert (1895), Unalaska Island. Gilbert says "a small stream entering Captains Harbor, Unalaska Island, has a series of impassable cascades aggregating several hundred feet in height. Above these falls the trout are very abundant, but are dwarfed in size and remarkably brilliant in coloration. They seem to reach no larger size than 8 inches". Cantwell (1885) Kobuk River. Murdoch (1885), near mouth of Colville River and at Pergniak. Nelson (1887), Golsova River. Scofield (1899), Port Clarence, Point Hope, and Herschel Island.

The Dolly Varden trout attains a weight probably of 25 pounds, though the largest seen by us in Alaska weighed less than 4 pounds. The maximum length of those we saw was 21.5 inches.

The average weight of 64 fish weighed at Pablof Falls was 1.5 ounces; length, 7 inches.

Twenty-four were examined at Snug Harbor, 16 males and 8 females. The males averaged 14.84 inches long and 11.28 ounces in weight; females, 17 inches long and 9.44 ounces in weight.

Four males and 12 females were examined at Karta Bay. The males averaged 14.375 inches long and 1.125 pounds in weight; females 15.77 inches long and 1.54 pounds in weight.

At Chignik Bay 15 males averaged 16.2 inches long and 1 pound 12 ounces in weight; 2 females, 17.75 inches long and 2.5 pounds in weight.

The 16 examined at Karta Bay were all that were found in a trap with about 300 to 400 sockeyes, 2 cohoes, and 3 starry flounders.

In the quiet portion of the Home Stream at Point Ellis (really a part of the upper end of a small lake), Dolly Varden trout were very abundant August 22. In one pool, 2 to 6 feet deep and 25 feet wide, we saw 500 to 600. They ranged in length from a few inches to 2 feet. They were certainly spawning, and they were not paired off but were all in a bunch. As one would swim over some clean gravel it would turn on its side and rub against the bottom, evidently to press out the eggs or milt.

In Heckman Lake, August 30, many were seen jumping.

In the Bristol Bay region this species appears to reach a larger size than elsewhere in Alaska. On July 4, 1906, Mr. John N. Cobb measured and weighed 27 examples (14 males and 13 females) from the Nushagak River. The largest male was 29.25 inches long and weighed 8.5 pounds; another that was 29.75 inches long weighed only 7.5 pounds. The largest female was 26.75 inches long and weighed 7 pounds, while another 27.25 inches long weighed but 6 pounds. The average of the 14 males was: Length 27 inches, weight 6.93 pounds; females, length 25.6 inches, weight 6.2 pounds. On July 19 Mr. Cobb examined 5 males and 1 female from the same river. These ran from 18 to 19 inches in length and 1.25 to 2 pounds in weight.

The salmon trout, to call it by another of its names, is the most persistent and destructive enemy of the salmon eggs and fry. When the sockeye, humpback, and coho are running upstream they are accompanied by vast numbers of salmon trout, which apparently have no other purpose than feeding upon their eggs. And the trout are quite as persistent in ascending rapids and jumping falls as are the salmon themselves. Not only during the spawning time do the trout remain, but so long as the eggs are to be found; and after the eggs have hatched the fry and fingerlings fall a ready prey to this voracious trout, which pursues them not only in the streams and lakes but down to salt water, where the destruction continues until the salmon have grown too large to be eaten.

On August 3, among the salmon at Afognak Falls, were hundreds—perhaps thousands—of the trout, all trying just as hard and just as successfully to ascend the falls. They jumped surprisingly well, sometimes it seemed even better than the salmon; even little ones not over 6 inches long would jump beautifully, and could maintain themselves in the vertical current quite well. Every possible resting pool, however small, had trout in it, and in the larger ones trout and salmon were mixed. There were some very large trout, and in a pool above the falls several of good size were seen.

Similar conditions were observed at Pablof Harbor, a small arm of Freshwater Bay, Chichagof Island, July 25. Into the head of this small bay empties Pablof stream, a small creek perhaps 50 feet wide. Near its mouth is a falls where the water drops by broken stages some 20 or 25 feet at low tide, but less at high tide. Below this falls were hundreds of humpbacks with a good many sockeyes and a few cohoes and dogs, all trying to get over the falls. With them were hundreds—perhaps thousands—of Dolly Varden trout and a good many cutthroat trout, all trying equally hard to ascend the falls. They could be seen in great numbers lying in the pools below or swimming about, or making heroic efforts to scale the falls. Every pool or possible resting place in the falls was literally packed with trout, 2 or 3 layers deep where the water permitted, all with their heads upstream. Among them in the larger pools was an occasional salmon.

The trout could be seen jumping quite as often as the salmon and apparently with even greater success in ascending the falls. They have an advantage in their smaller size, being able to find resting places in the small nooks and eddies. They are able, however, to jump very well, and to maintain themselves against or even to ascend a practically vertical current.

Ordinarily the Dolly Varden trout does not take high rank as a game fish; it is usually loggy, never jumps, and makes a poor fight. But this is not always the case; much depends upon the water, the particular fish, and perhaps other factors.

One of us has found that these trout are very good fighters in the swiftly flowing waters of Idaho, particularly in the Salmon River and elsewhere in the Sawtooth Mountains. In Alaska they are very good game fish, and there is scarcely a stream or lake in that country where the angler may not find excellent sport with them. We have angled for them in many Alaskan waters, among which may be mentioned the Naha Stream and lakes near Loring, small streams near Unalaska, Indian River, and creek at Silver Bay near Sitka, Afognak Falls, and Pablof Falls. At the last-named place we found them unexpectedly gamey. A 12 to 15 inch fish in this turbulent water was able to make a fight that would delight the heart of any angler. Moreover, these trout rise to the fly readily, take it with a rush, and do not give up the fight until safe in the creel. Even when lifted from the water or placed in the landing net they continue to flop with great vigor, so that it is not an easy matter to remove the hook. They do not often jump from the water when hooked, though they occasionally do.

The best flies were small ones of red color; those most resembling salmon spawn were the most killing. A fly of this kind used at Pablof Falls would scarcely touch the water before dozens of trout would vie with each other in frantic efforts to seize it. Occasionally a fish would discover the nature of the fly and turn away, but usually one of them would take it. Salmon spawn, however, is the bait that never fails.

Our experiences at Pablof Falls showed that "tickling trout" is as possible in Alaska as in England. While fishing from a ledge out near the middle of the falls we noticed some trout resting in a relatively quiet pool part way up the falls. By reaching one's hand into the water and carefully touching a fish near the tail, then moving the hand forward, gently rubbing the belly and side, and then closing down upon the fish when the hand reached the head, it was possible to lift the fish out of the water without disturbing any of the others. In this way we secured quite a number for our creel. At first they were quite heedless of the hand, but when one became alarmed and, being very slick, got away, all the others in the pool were apt to become greatly disturbed and scurry away pellmell, going down to the foot of the falls.

The ovaries of all of these trout were quite small and immature, and this was evidently not their spawning season. It is doubted whether their efforts to ascend these falls were actuated by a desire to reach their own spawning beds. The only rational explanation of their running upstream at this time is that it was for the purpose of reaching the spawning beds of the salmon that they might feed upon the salmon eggs.

Family 14. THYMALLIDÆ. The Graylings.

37. **Thymallus signifer** (Richardson). *Alaska Grayling; "Tahseh"* (Indian name). (Pl. XLI.)

Very abundant in the headwaters of the Yukon. July 18 to 20 numerous specimens were collected in Tagish Arm near Caribou Crossing and from Kilbourne Creek, a small stream flowing into Tagish Arm. Others were seined in the outlet of Lake Bennett, north of the station at Caribou Crossing. At Lake Bennett, July 20 and 21, several small examples were seined near the head of the lake and several larger ones were taken with the fly. One particularly fine example (no. 2928), 15 inches long and weighing 1 pound and 2 ounces, was taken on the hook near the railroad station at Lake Bennett. A special agent of the Yukon and White Pass Railroad caught several in a small lake near Log Cabin, which is between Lake Bennett and Caribou Crossing. The fish is said to occur also in Lake Atlin and in Fortymile Creek, in which it is reported to reach a very large size.

The grayling is probably of wide distribution in northern Alaska, particularly throughout the Yukon basin. Mr. Frank Hess, of the Geological Survey, reports it from Sinuk River, about 35 miles northwest of Nome, and he was informed that it occurs in the same river 70 miles northwest of Nome. He found it also in Kuzitrin River 35 miles northeast of Council, in Niukluk River at Council, in El Dorado Creek (a tributary of Noxapaga River) 125 to 150 miles northeast of Nome, and in the Kugruk River 110 to 120 miles north of Nome. On August 9 he saw them spawning in streams 40 miles north of Fairbanks. It was found also in Kugruk River (a different stream flowing into Kotzebue Sound) by Mr. Fred H. Moffit, of the Geological Survey. Mr. Frank C. Schrader found it in 1902 in Colville River and in other streams and lakes of that region. Mr. Walter C. Mendenhall, also of the Geological Survey, says that grayling may be found in all of the clear-water streams of the Kobuk Valley.

Mr. E. W. Nelson, of the Biological Survey, reports the grayling from a small stream flowing into the Arctic Ocean just north of Cape Lisburne, about halfway between Kotzebue Sound and Point Barrow. This stream is only 12 to 15 miles long and the grayling were seen in a small pool about halfway up the stream. They were only a few in number and were adults 12 to 15 inches long. According to Mr. Nelson, grayling occur in all the streams entering Norton Sound; also in the upper tributaries of the Yukon some 30 to 35 miles northeast from St. Michael. They do not occur in the streams down in the flats, but up in the hills they are in every clear stream. Dolly Varden trout are most abundant in the larger streams, grayling in the smaller ones.

The examples taken with the fly at Caribou Crossing and Lake Bennett varied in length from 4.5 to 15 inches. The respective lengths in inches of 27 specimens measured are as follows: 4½, 4⅝, 5⅜, 6, 6½, 6½, 7, 7, 7½, 7¾, 7$\frac{7}{16}$, 7⅝, 8, 8, 8½, 8½, 8½, 8⅞, 9, 9½, 10, 10, 10¾, 11, 11⅜, 13¾, and 15 inches, the average being nearly 8.5 inches.

The example from which the painting was made was 12½ inches long and was obtained at Caribou Crossing in August, 1903.

The 15-inch example (no. 2928) from Lake Bennett was described in life as follows:

Head 5.25 in body; depth 4.28; eye 4 in head; snout 4.6; maxillary 6; mandible 2; dorsal 21; anal 11, the last ray broad and firm; scales 10–93–10.

Body elongate, compressed, highest about the origin of the dorsal, from which the contour slopes gradually to the slender caudal peduncle; head small, somewhat pointed; mouth terminal, moderate, the maxillary extending to below middle of eye; mandible extending to nearly posterior edge of orbit; teeth minute, numerous in both jaws and along maxillary, none on tongue; eye large, longer than snout, but not equal to interorbital space.

Scales on side about uniform in size; the caudal fin well scaled, two rows of small scales forming radiating feather-like projections on some of the interradial spaces of the lobes of the fin; a naked patch back of isthmus; scales of jugular region minute, becoming larger backward and upward.

Dorsal fin long and high, the longest ray about 4 in body, its base 4.5; adipose fin small; longest ray of anal 2 in head, its base about the same length; gillrakers medium length, firm, rather stout, acute, 6+13 and 6+12.

Color in life, back light olive, edges of scales dark; side bluish silvery, centers of scales brightest; belly dull white, a dirty, rusty wash from base of ventral to lower part of pectoral; when scales rub off an orange color is shown; anterior part of side with 11 or 12 small blue-black spots; cheek somewhat rosy; membrane between rami of lower jaw black; dorsal olive, with 3 rows of rosy or purplish, lighter-edged, almost coalescing spots at base, above these about 6 less distinct rows of more isolated spots of same color; distal edge of fin purplish, posterior edge blackish above; ventrals olive, with 5 longitudinal purplish lines; pectoral, caudal, and anal olive, the caudal somewhat dark at base and edge.

A 10-inch specimen and 10 others taken at Caribou Crossing, July 18, had the following colors in life:

Back olive, the centers of scales lighter; side silvery, underlaid with olive; borders of scales dull golden; 10 inky black spots, irregularly arranged on anterior part of body, mostly below lateral line, these varying much, numbering from 3 to 17 in the 10 specimens at hand; one specimen has over 70 spots, rather paler, and arranged in irregular rows, extending back to adipose dorsal; head olive, with bluish luster, with some gold and brassy; a blue-black blotch under rami of lower jaw; branchiostegals brassy; dorsal dusky olive, upper edge blue-black, 4 rows of spots, the upper violet blue, others anteriorly violet, posteriorly reddish or yellowish green, a fifth partial row (6 on some), the smaller fish with spots less distinct; adipose dorsal dusky olive; caudal dusky with a submarginal paler streak; anal olive, dusky at tip; ventral dusky anteriorly, with 3 lengthwise strips of bright cream color; pectoral greenish; inside of opercle bluish.

Color in alcohol (No. 2928), back and upper parts of side pearly blue, somewhat paler below, nearly everywhere finely punctulate with minute black dots, but especially so in a streak on each side extending from the base of the pectoral to origin of ventral fin; a black or dark blue streak each side of chin, almost concealed by fold of jaw; a few (5–10) roundish blue spots along anterior part of side; dorsal fin highly colored, the ground-color dark blue, interrupted by elongate elliptical pink or red spots, these extending in rows between rays, their long axis parallel with those of the rays, the spots also in rows parallel with the back, almost forming continuous lines near the base of the fin; ventrals bluish dusky, with longitudinal bright dashes; other fins dusky.

Most of the grayling from Caribou Crossing were taken with a fly from a small pier at the mounted police station a few rods below the railroad bridge, in water 2 to 5 feet deep. A very small fly (black gnat) was used. The fish took it either at the surface or when it was sunk a foot to 3 feet. The local anglers usually fish with the artificial fly and, of course, without any sinker, simply whipping the surface or allowing the fly to float down. Some, however, use a very light sinker and find that the grayling will sometimes take the fly even better when it is sunk 2 or 3 feet. Very small bits of fresh red meat are sometimes used and found attractive.

Considering the small size of these fish they were quite good fighters and afforded much sport. Those taken in the swift water of Kilbourne Creek seemed decidedly more gamy, partly, doubtless, on account of the current, but they were really better fighters.

The 15-inch example from Lake Bennett was caught while we were still-fishing from a pier near the hotel. This fish was seen in water 4 feet deep and was repeatedly tried with various kinds of flies, but it paid no attention to any of them. As a last resort a small piece of fresh, red meat was placed on the fly, when the fish rose at once and took it greedily, proving very energetic and vigorous, and making a very pretty fight.

Family 15. ARGENTINIDÆ. The Smelts.

38. **Mallotus villosus** (Müller). *Capelin.*

Eight (4 male, 4 female) specimens 3.5 to 5 inches long, collected by the *Albatross* at Port Chester, September 26, 1900, and one 4 inches long from Loring, 1904.

Recorded also by Bean (1882) from Sitka; Chugachik Bay and Refuge Cove, Cook Inlet; off Marmot Island; St. Michael; Bering Strait; Cape Lisburne and Point Belcher, Arctic Ocean. Gilbert (1895), stations 3235, 3238, and 3240, Bristol Bay. Murdoch (1885), Point Barrow. Nelson (1887), Golovina Bay. Turner (1886), Atka Island. Scofield (1899), Port Clarence.

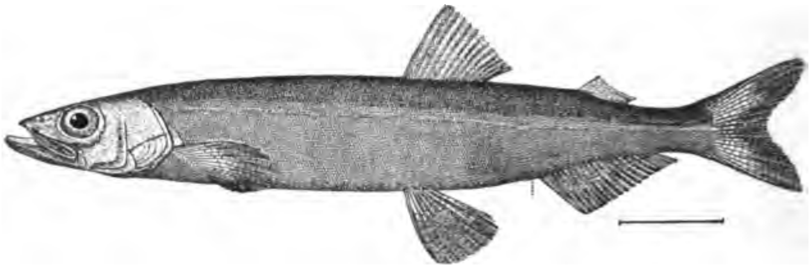


FIG. 13.—Mallotus villosus (Müller).

The capelin is an abundant fish in Alaska, often seen in large schools on the cod grounds. It is one of the principal foods of the cod, as many as 40 having been found in one cod's stomach. It is preyed upon largely also by the halibut and by whales. It reaches a length of 10 inches or less and is a very delicious food-fish which has not as yet been utilized in Alaska to any extent.

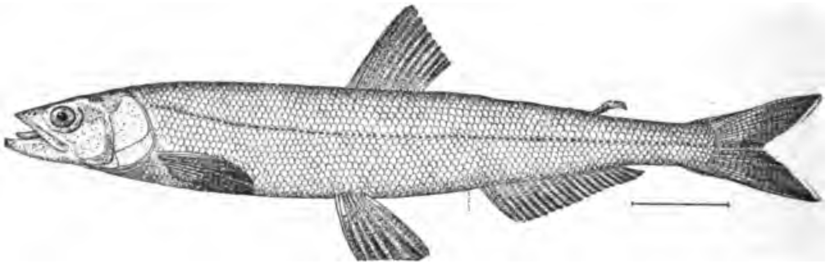


FIG. 14.—Thaleichthys pacificus (Richardson).

39. **Thaleichthys pacificus** (Richardson). *Eulachon.*

Recorded by Bean (1882) from Stikine River; Wrangell; Sitka; Chilkat River; and Katmai. Gilbert (1895), near the mouth of Nushagak River. Not taken by us.

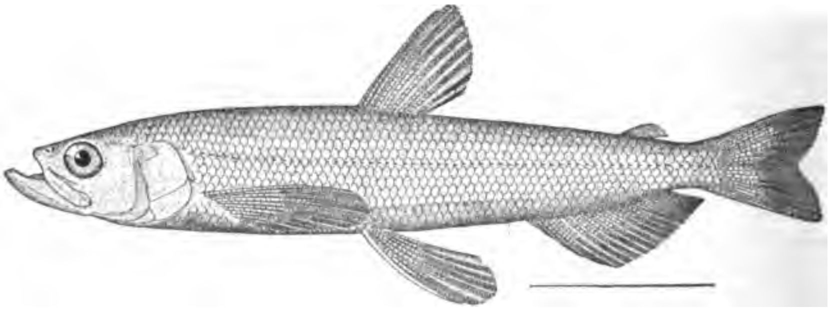


FIG. 15.—Osmerus thaleichthys (Ayres).

40. **Osmerus thaleichthys** (Ayres). *California Smelt.*

Recorded by Gilbert (1895) from Nushagak River, from which he again obtained 5 examples in 1903. They are 2.5, 2.75, 2.87, 3, 3.63 inches long, respectively. The largest and one other have the mouth strikingly different from the remaining specimens—maxillary teeth absent and the maxillary short and broad, while in the others it is long and narrow.

41. **Osmerus dentex** Steindachner. *Arctic Smelt.*

One specimen 4 inches long collected by the *Albatross* in Bristol Bay in 1890–91, and one 11 inches long at Tareinski Harbor in 1900; one 5 inches long at station 3231, Bering Sea, June 2, 1890. Also recorded by Bean (1882) from Port Mulgrave, Yakutat Bay, and from St. Michael and Port Clarence.

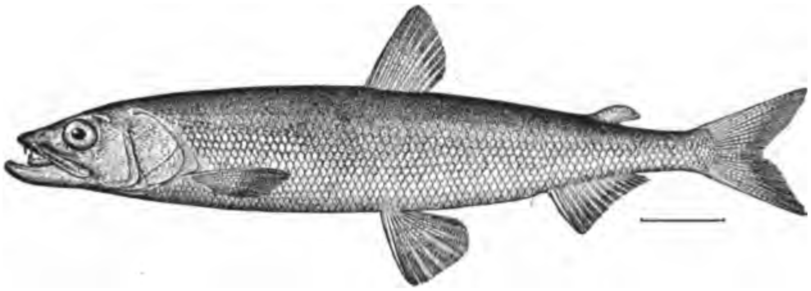


FIG. 16.—Osmerus dentex Steindachner.

Gilbert (1895), Naknek and Nushagak rivers and station 3231 in Bristol Bay. Wainwright Inlet near Point Barrow (Murdoch 1886); St. Michael (Nelson 1887); Port Clarence (Scofield 1899). We have recently examined a specimen obtained in 1904 by Mr. Edward A. Preble in the Arctic Red River, a tributary to the Mackenzie.

42. **Osmerus albatrossis** Jordan & Gilbert. (Pl. XIV, fig. 2.)

One specimen 5.25 inches long taken by the *Albatross* at station 3536, Bering Sea, and 2 specimens 3 and 3.5 inches long, from station 3789.

Originally described from Albatross station 3675 in Shelikof Straits (Jordan & Gilbert 1899).

43. **Hypomesus pretiosus** (Girard). *Surf Smelt.*

Nine specimens 2.75 to 6 inches long were seined in Kilisut Harbor; 16 specimens, 3.75 to 5.75 inches long, at Admiralty Head, Whidby Island; and one, 5.25 inches long, at Dundas Bay. The species has been recorded by Bean (1882) from Port Mulgrave, Yakutat Bay.

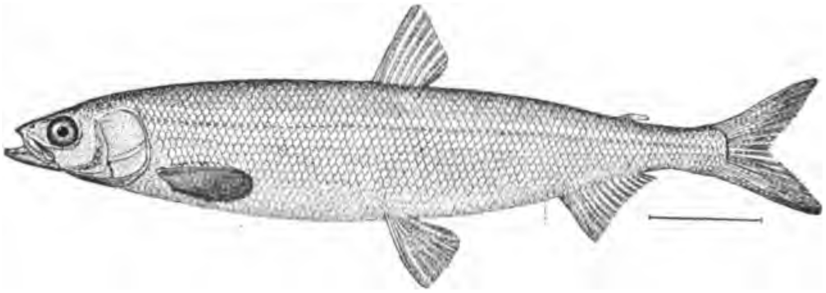


FIG. 17.—Hypomesus pretiosus (Girard).

In the specimens at hand the ventrals are inserted in front of the middle of the dorsal; in other respects the specimens agree well with current descriptions. A specimen 5.75 inches long is described as follows: Head 5; depth 5; eye equal to snout, 4 in head; dorsal 9; anal 14; pectorals 14; ventrals 8.

44. **Hypomesus olidus** (Pallas).

One specimen collected by the *Albatross* at Tareinski Harbor. Recorded from St. Michael (Turner 1886, Bean 1882), and from rivers back of Grantley Harbor (Scofield 1899). No Alaskan specimens seen by us.

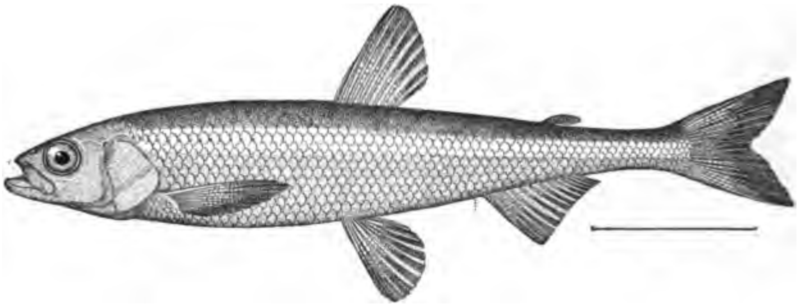


FIG. 18.—Hypomesus olidus (Pallas).

45. **Leuroglossus stilbius** Gilbert.

Recorded by Gilbert (1895) from station 3330, off northern shore of Unalaska.

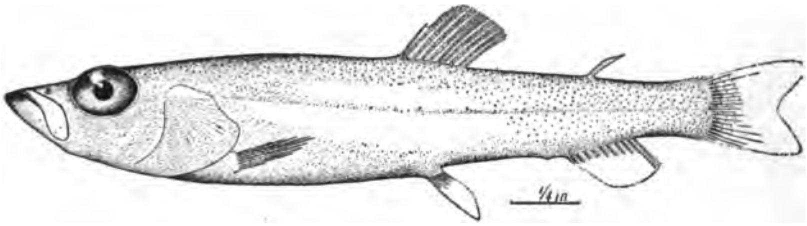


FIG. 19.—Leuroglossus stilbius Gilbert.

Family 16. MICROSTOMIDÆ.

46. **Bathylagus borealis** Gilbert.

Originally described from Albatross station 3327, north of Unalaska (Gilbert 1895).

Family 17. MYCTOPHIDÆ.

47. **Lampanyctus gemmifer** Goode & Bean.

Six specimens 3 to 4.25 inches long, dredged at station 4255, in Lynn Canal July 16, 1903.

48. **Nannobrachium leucopsarum** (Eigenmann & Eigenmann).

One specimen 3.5 inches long was picked up on the beach at Wrangell. Recorded by Gilbert (1895) from stations 3227, 3307, 3308, 3325, and 3329, all in Bering Sea, north of Unalaska Island.

49. **Nannobrachium nannochir** (Gilbert).

Two specimens 3.5 and 4.5 inches long, dredged at station 4267, off Mount Edgecumbe; 3 specimens 1.5 to 2 inches long, dredged at station 4257, in Lynn Canal, and 2 specimens 1 and 1.5 inches long, dredged at station 4235, in Behm Canal.

This species has been recorded by Gilbert (1895) from stations 3211, 3307, 3308, 3327, 3329, 3338, 3340, 3342, and 3348, including the entire North Pacific and Bering Sea.

50. **Diaphus theta** Eigenmann & Eigenmann.

One specimen 2.5 inches long dredged at station 4267, off Mount Edgecumbe in 922 fathoms. Head 3; depth 4.5; eye 3; snout about 3 in eye; dorsal 12; anal 9; pectorals 12; lateral line 35.

Family 18. CHAULIODONTIDÆ.

51. **Cyclothone microdon** (Günther).

Recorded by Gilbert (1895) from Albatross stations 3307 and 3308 in Bering Sea. Not taken by us.

52. **Chauliodus macouni** Bean.

One specimen 4.25 inches long from station 4231, Behm Canal near Loring, and another 3.5 inches long from station4 257, in Lynn Canal. Also recorded from station 3340, south of Alaska peninsula (Gilbert 1895).

Family 19. PLAGYODONTIDÆ.

53. **Plagyodus æsculapius** Bean.

Originally described by Bean (1884) from Iliuliuk, Unalaska. Recorded also from Summer Harbor, Unalaska (Jordan & Gilbert 1899).

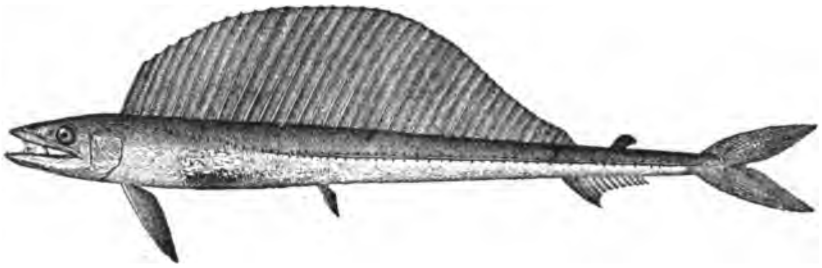


FIG. 20.—Plagyodus æsculapius Bean.

54. **Plagyodus borealis** (Gill).

Recorded from Captains Harbor, Unalaska (Bean 1882).

Family 20. NOTACANTHIDÆ.

55. **Macdonaldia challengeri** (Vaillant).

Recorded by Gilbert (1895) from Albatross station 3308 in Bering Sea.

Family 21. DALLIIDÆ.

56. **Dallia pectoralis** Bean.

This interesting fish, which is the sole representative of a family and order of fishes, was first described by Bean (1880), from specimens collected by its discoverer, Dr. Dall, at St. Michael. Specimens were also reported by Nelson (1887) from Andreafski, Yukon River, and mouth of Tanana River, and by Gilbert (1895) from Nushagak River. It occurs in great numbers on St. Lawrence Island. We have but a single specimen, one secured by Gilbert. Although so abundant in Alaska, this species is rare in museums and collections in general, illustrating the well-known fact that the commonest forms in nature are often the rarest as preserved specimens Turner (1886) says:

This species is probably the most abundant of all the fishes which occur in the fresh and brackish waters of the northern part of Alaska. It is found in all the small streams of the low grounds, in the wet morasses and sphagnum-covered areas, which are soaked with water and which at times seem to contain water sufficient only to moisten the skin of the fish. In the low grounds or tundra are many, countless thousands, small ponds of very slight depth, connected with each other by small streams of variable width. * * * These narrow outlets of the ponds are at certain seasons so full of these fish that they completely block them up. The soft, yielding sphagnum moss above is pushed aside, and under it these fish find a convenient retreat. Here the fish are partially protected from the great cold of winter by the covering of moss and grass. In such situations they collect in such numbers that figures fail to express an adequate idea of their numbers. They are measured by the yard. Their mass is deep according to the nature of the retreat. * * * The natives repair to the places which are known to be the refuge of these fish and set a small trap. * * * The natives remove the trap every day or two to relieve the pressure on it and to supply their own wants and those of their dogs. * * * From May to December, tons and tons of these fish are daily removed. They form the principal food of the natives living between the Yukon Delta and the Kuskokwim River and as far interior as the bases of the higher hills. North of the Yukon Delta they are also abundant. The natives sell many of these fish in baskets, a few cents paying for about three-fourths of a bushel. When taken from the traps the fish are immediately put into these baskets and taken to the village, where the baskets of fish are placed on stages out of the way of dogs. The mass of fish in each basket is frozen in a few minutes, and when required to take them out they have to be chopped out with an ax or beaten with a club to divide them into pieces of sufficient size to feed to the dogs.

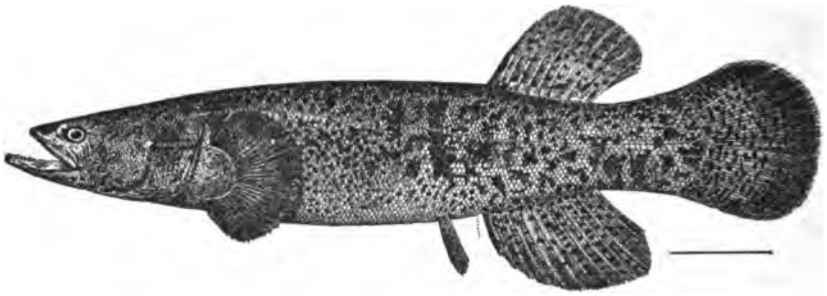


FIG. 21.—Dallia pectoralis Bean.

The vitality of these fish is astonishing. They will remain in those grass baskets for weeks, and when brought into the house and thawed out they will be as lively as ever. The pieces which are thrown to the ravenous dogs are eagerly swallowed, the animal heat of the dog's stomach thaws the fish out, whereupon its movements soon cause the dog to vomit it up alive. The food of these fish has always been a matter of wonder to me, considering the number of fish to be supplied in the scanty waters where they abound. The contents of several stomachs were examined and found to contain only a mass of undistinguished earthy matter, vegetable fragments, and what appeared to be the undigested portions of skins of small worms which frequent the ponds and low grounds. The spawning season is in June and July, or as soon as the lagoons thaw out sufficiently. The eggs are deposited in the vegetable slime at the bottoms of the small ponds.

According to Petroff, this little fish is found in all the shallower channels and lagoons throughout the delta between the mouths of the Kuskokwim and Yukon rivers in such quantities as to furnish subsistence for whole settlements in the most desolate regions where nothing else could be found to sustain life at certain seasons of the year. It is said that the people inhabiting these regions are in better condition physically when spring approaches than any of their neighbors in regions where it does not exist, they being almost exempt from the annual period of starvation elsewhere preceding the run of salmon in the rivers. The blackfish is exceedingly fat and a good quality of oil is obtained from it.

Family 22. ESOCIDÆ.

57. **Esox lucius** Linnæus.

Recorded from Yukon River (Bean 1882); common in Kobuk River (Townsend 1887); Andreafski, Yukon River (Nelson 1887). No specimens were obtained by us, but we were informed that it occurs in Lake Atlin and Tagish Arm.

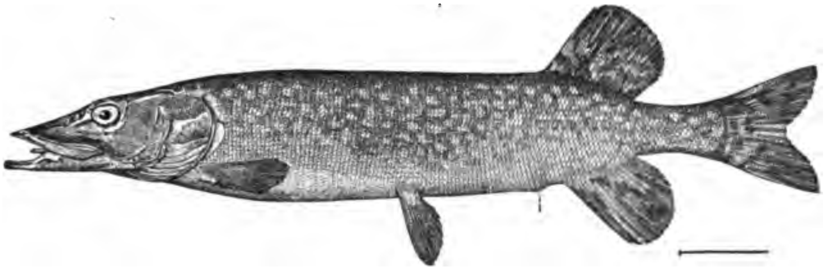


FIG. 22.—Esox lucius Linnæus.

Family 23. GASTEROSTEIDÆ. The Sticklebacks.

58. **Pygosteus pungitius** (Linnæus).

This species has been recorded by Turner (1886), from St. Michael. Gilbert (1895), from Nushagak and Naknek rivers. Rutter (1899), brook near mouth of Alitak Bay, Kodiak Island. Scofield (1896), Grantley Harbor. Nelson (1887), as *Pygosteus pungitius brachypoda*, from Andreafski, Yukon River, and St. Michael. Turner (1886), Sannak Island. Bean (1882), St. Paul, Kodiak Island; Unga Island; Iliuliuk Lake, Unalaska; St. Paul Island; St. Michael; Port Clarence; Elephant Point, Eschscholtz Bay; near Icy Cape, Arctic Ocean. Murdoch (1885), Point Barrow.

Numerous (probably 500) specimens taken by Dr. Gilbert in a small lake at Koggiung. Two specimens 2.26 and 1.75 inches long taken along with young salmon in sloughs or little pools of quiet water along edge of Karluk River near its source, by Mr. Rutter in 1903. These specimens differ from current descriptions, therefore, in having an increased number of spines, and the ventral spines somewhat shorter.

The following is a description of the larger specimen, 2.26 inches long:

Head 4 in body; depth 5; eye 3.75 in head; snout 3.75; maxillary 4; mandible 4; interorbital 4.6; dorsal X-I, 9; anal I, 9.

59. **Gasterosteus cataphractus** (Pallas).

Numerous specimens from the following localities: Admiralty Head and Kilisut Harbor near Port Townsend; Shawnigan Lake, Vancouver Island; Alert Bay; Mink Arm, Boca de Quadra; Loring (from both salt and fresh water); Lake McDonald and Yes Bay; Kasaan Bay; Ankau River; Karluk Lake and connecting streams and sloughs; Alitak Lake, Kodiak Island; St. Paul Island, Pribilof Group; Sitka; and Pablof Falls.

The species had been previously recorded by Turner (1886) from Sannak Island. By Bean (1882) from Sitka; Port Mulgrave, Yakutat Bay; Refuge Cove and Chugachik Bay, Cook Inlet; St. Paul, Kodiak Island; Sanborn Harbor, Unga Island; Humboldt Harbor and Little Koniushi Island, Shumagins; Iliuliuk, Unalaska; Amchitka; Kyska Harbor and St. Paul Island. Lakes of Kodiak Island and Karluk estuary (Rutter 1899). Grantley Harbor (Scofield 1899). As *Gasterosteus microcephalus* (Bean 1884) from Piseco Lake, Sitka; St. Paul, Kodiak; Chirikof Island; Iliuliuk Lake, Unalaska, and Mountain Lake, near Wards Cove.

The specimens from Karluk Lake were obtained by Mr. Rutter from a large school seen in the river near its connection with a side lake and from sloughs or pools of quiet water along the river near its source. These range in length from 2 to 4 inches. The largest of these last specimens have the lateral plates scarcely evident; the smaller specimens show no plates at all. Examples taken at Lake McDonald August 24 were full of nearly ripe eggs, as were also those taken at Kilisut Harbor July 1.

Among the great number of specimens collected by Mr. M. C. Marsh on St. Paul Island in 1906, nearly 200 small examples were obtained from a landlocked fresh-water lake and these are not so fully plated as are larger examples from the same lake. Many of the Loring specimens were infested with intestinal parasites.

Eighteen different localities in Alaska, eight of which are salt water, are represented in our collection of *Gasterosteus*. Every specimen from the salt water is fully plated. Those found in the lakes or well up the streams usually have fewer plates than those taken in or near the sea, the variation being from 3 plates to a fully plated condition. Those in a fresh-water landlocked lake on St. Paul Island, however, are fully plated. With this exception (and this lake is not strictly a fresh-water lake), our collections indicate that whenever sticklebacks begin living in fresh water they begin losing their plates, and a continued residence there tends to the disappearance of most of the plates.

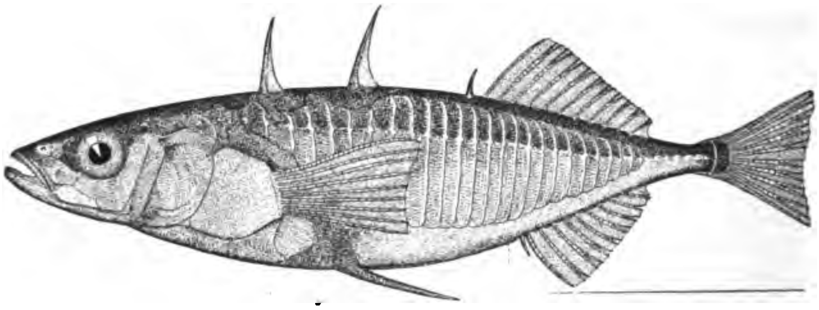


FIG. 23.—Gasterosteus cataphractus (Pallas).

An examination of our specimens from various localities gives the following results:

Hatchery Lake near Loring, 2 specimens, 6 plates; pubic plate and spines well developed, not reduced.

River connecting with side lake, Lake Karluk, 2 specimens, 4 and 6 plates; spines well developed; pubic plate not reduced.

Loring, 6 specimens, 3 plates, only 1 plate fully developed; pubic plate and spines not reduced; pectorals small.

Lake Karluk, about 20 specimens, 4 to 12 plates; pubic plate and spines not reduced.

Loring, outlet second lake, 1 specimen, 3 plates; spines and pubic plate well developed.

Loring, at head of bay, many small specimens, few plates; spines and pubic plates well developed.

Heckman Lake, 4 specimens, 3 plates; spines and pubic plate well developed.

Karluk Lake, 12 specimens, 3 to 8 plates; spines and pubic plate well developed.

Head of Mink Arm, 77 specimens, all fully plated; pubic plate and pectoral not different from fresh-water specimens.

Admiralty Head, 1 specimen, fully plated; spines and pubic plate well developed.

Kilisut Harbor, 13 specimens, fully plated; spines and pubic plates well developed.

Loring, near head of Bight, 2 specimens, fully plated; spines and pubic plate well developed.

Loring, at head of Naha Bay, 12 specimens, plates well developed; others well developed, as are the spines and pubic plates.

Kasaan Bay, 1 specimen, plates all developed.

Head of Yes Bay, 25 specimens, fully plated.

Family 24. AULORHYNCHIDÆ.

60. **Aulorhynchus flavidus** Gill.

Eleven specimens, 1.15 to 2.15 inches long, seined at Quarantine Dock, near Port Townsend; 3 specimens, 1.25 inches long, taken in kelp near pier at Port Townsend, 5 from Loring, and 1 from Alert Bay. The species has also been recorded from Sitka by Bean (1882.)

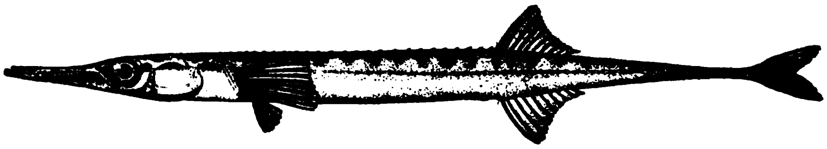


FIG. 24.—Aulorhynchus flavidus Gill.

Family 25. SYNGNATHIDÆ. The Pipefishes.

61. **Siphostoma griseolineatum** (Ayres).

Four specimens, 4 to 9 inches long, taken at Loring; one a male, 6.75 inches long, had eggs and young in its pouch; 3 females, 6.5 to 8 inches long, seined at Kilisut Harbor; 2 females, 5.5 and 11.5 inches long, seined at Metlakahtla; one specimen, 5 inches long, seined in Taylor Bay, Gabriola Island. We have also 2 specimens, one taken at Loring and one at Yes Bay in 1905, and one other taken at Port Ludlow in 1895.

Family 26. AMMODYTIDÆ. The Sand Launces.

62. **Ammodytes personatus** Girard.

Collections were made by the *Albatross* as follows: One specimen, 3.75 inches long, at Sucia Island, May 6, 1894; 13 specimens, 3.5 to 7 inches long, south side of Akatan Bay, Aleutian Islands, July 20, 1894; 42 specimens, 3 to 5 inches long, at Agattu Island, June 6, 1894: 6 specimens, 3 to 5 inches long, taken at Atka Island, June 10, 1894; one specimen, 4 inches long, at station 3595; 52 by Mr. Rutter at Uganuk in 1897; 2 specimens, 4 and 4.25 inches long, at Unalaska, July 2, 1900; 118 specimens, 2 to 6.25 inches long, were taken in 1903 at Admiralty Head; Loring; Metlakahtla; Pablof Harbor; Uganuk, Uyak Bay, and Shakan Bay.

In addition to the specimens in the collection, the species was seined in abundance in Pablof Bay and also observed at station 4242 in Karta Bay, at Port Alexander, and Kilisut Harbor. It is frequently found in the stomachs of other fishes—in the stomach of a halibut at Loring, and many in the stomachs of sockeyes; many were also found in the stomach of a Dolly Varden trout.

The species has been recorded by Bean (1882), as *Ammodytes americanus*, from Sitka; Port Mulgrave, Yakutat Bay; Chugachik and Port Chatham, Cook Inlet; Semidi Islands; Humboldt Bay, Shumagins; Iliuliuk, Captains Harbor, and Chernoffsky, Unalaska; ConstantineBay, Amchitka; Port Clarence; and Point Belcher, Arctic Ocean. Also by Bean in 1884 (as *A. personatus*) from Wrangell and Port Chester. Gilbert (1895), Unalaska; Chernoffski; Herendeen Bay and Hagemeister Island. Nelson (1887), St. Michael; and Scofield (1899), Chignik and Port Clarence.

Small boys, seen using this fish at Sitka for bait in fishing for "black bass" (*Sebastodes melanops*), called them "needlefish." They are abundant along the Alaskan coasts at least as far north as the Aleutian Islands, going in great schools and frequenting sandy shores, where they quickly bury themselves in the sand when disturbed. At Unalaska in 1892 one of us saw more than a barrel taken in one haul with a short seine. More delicious little fish probably do not exist. They are usually prepared by rolling in fine corn meal or cracker crumbs and frying in butter.

Family 27. BERYCIDÆ.

63. **Plectromus lugubris** (Gilbert).

Recorded from station 3327, north of Unalaska (Gilbert 1895), as *Melamphaes lugubris*.

POSITION OF YOUNG IN GRAVID EXAMPLES OF CYMATOGASTER AGGREGATUS.

No. of specimen.	Locality and date.	Length.	Young with head forward.	Young with head backward	Total young.	No. of specimen.	Locality and date.	Length.	Young with head forward.	Young with head backward.	Total young.
		Inches.						*Inches.*			
1	Gabriola Island (June 20)	5.0	13	1	14	42	Union Bay, Vancouver Island (June 23)	4.75	5	3	8
2	.....do	5.25	12	5	17	43	.....do	6.0	15	1	16
3	.....do	5.5	13	5	18	44	.....do	5.25	11	6	17
4	.....do	5.5	10	6	16	45	.....do	5.5	11	5	16
5	.....do	5.5	11	4	15	46	.....do	6.0	16	3	19
6	Union Bay, Vancouver Island (June 23)	6.0	14	5	19	47	.....do	5.0	11	2	13
7	.....do	5.5	15	2	17	48	.....do	6.0	14	3	17
8	.....do	5.0	10	1	11	49	.....do	5.5	12	3	15
9	.....do	5.5	10	4	14	50	.....do	4.75	10	2	12
10	.....do	5.0	10	5	15	51	.....do	5.0	11	1	12
11	.....do	6.0	10	3	13	52	.....do	5.0	10	2	12
12	.....do	6.5	25	2	27	53	.....do	5.0	7	3	10
13	.....do	5.5	15	5	20	54	.....do	5.5	12	3	15
14	.....do	5.5	14	2	16	55	Gabriola Island (June 20)	5.0	......	......	15
15	.....do	5.0	12	3	15	56	.....do	5.5	......	......	20
16	.....do	6.0	12	4	16	57	.....do	6.0	......	......	27
17	.....do	5.0	8	2	10	58	.....do	5.5	......	......	17
18	.....do	5.0	16	2	18	59	.....do	6.0	......	......	21
19	.....do	6.0	13	2	15	60	.....do	5.0	......	......	14
20	.....do	5.5	11	4	15	61	.....do	5.75	......	......	15
21	.....do	5.0	11	3	14	62	.....do	5.75	......	......	18
22	.....do	5.0	11	0	11	63	.....do	5.5	......	......	15
23	.....do	5.0	16	1	17	64	.....do	5.25	......	......	17
24	.....do	6.5	19	3	22	65	.....do	6.0	......	......	21
25	.....do	5.5	9	6	15	66	.....do	5.0	......	......	11
26	.....do	5.0	13	1	14	67	.....do	5.5	......	......	20
27	.....do	5.0	9	5	14	68	.....do	5.25	......	......	11
28	.....do	5.5	12	2	14	69	.....do	5.25	......	......	15
29	.....do	5.5	15	2	17	70	.....do	5.75	......	......	20
30	.....do	5.5	12	2	14	71	.....do	5.0	......	......	12
31	.....do	5.0	9	4	13	72	.....do	5.75	......	......	20
32	.....do	5.0	9	3	12	73	.....do	5.0	......	......	18
33	.....do	5.0	9	3	12	74	.....do	5.5	......	......	20
34	.....do	5.0	7	5	12	75	.....do	5.5	......	......	21
35	.....do	5.0	12	1	13	76	.....do	5.0	......	......	13
36	.....do	4.75	9	2	11	77	.....do	5.25	......	......	16
37	.....do	5.5	13	1	14	78	.....do	5.0	......	......	12
38	.....do	6.0	23	1	24	79	.....do	5.0	......	......	11
39	.....do	5.5	3	9	12	80	.....do	5.0	......	......	24
40	.....do	6.5	20	2	22	81	.....do	5.0	......	......	20
41	.....do	5.25	12	1	13	82	Kilisut Harbor (July 1)	6.75	......	......	36

Color of female in life, silvery; back olive-greenish or brassy; side with 2 broad vertical brassy bars, between which and in front and back of which the scales are whitish, and with a large black blotch of small specks; top of head olive; belly white; dorsal and caudal olive, other fins white.

"Surf-fish" is a very appropriate name for this little species. During the spawning season it swarms in great numbers in the surf or in shallow water along sandy shores. Every haul of the seine at Kilisut Harbor and about Nanaimo and Fort Rupert resulted in the capture of great numbers.

The spawning season on the coast from Puget Sound to Fort Rupert is evidently during the last days of June and the first days of July, and the fish seem to come into shallow water along the shore to liberate their young. There is evidence indicating that the more quiet, shallow reaches of shore are then selected as affording the least danger to the delicate young fish. The fact that numerous females captured at Karta Bay July 11 were all spent fish indicates that the spawning period is a brief one.

The number of females seems to be in excess of the males. Of 90 fish examined at Fort Rupert, 66 were females, and about the same proportion held elsewhere. The preponderance of females may, however, be more apparent than real. The males are considerably smaller than the females, and it may well be that some were overlooked in the mass of material resulting from each seine haul.

The white surf-fish will take the hook, but is too small to be of much interest as a game fish. It is said to be a very fair pan fish.

67. **Tæniotoca lateralis** (Agassiz). *Blue Perch; Striped Surf-fish.*

The only example seen was seined at Kilisut Harbor, July 1. Color in life, reddish brassy, greenish on head and back; side and back with many narrow, pale bluish lines, half width of brassy interspaces; underparts paler brassy; fins dusky brassy.

68. **Damalichthys argyrosomus** (Girard). *White Viviparous Perch; Porgee.*

This species was found at Diamond Point, Kilisut Harbor, and Marrowstone Point, June 27 and July 1; Taylor Bay, Gabriola Island, June 20; and Union Bay, Vancouver Island, June 23. It was not abundant anywhere, but was most common at Union Bay. A female examined at Gabriola Island was 14 inches long and contained 23 young, each about 1.9 inches long. Four other examples measured were 2.75, 5.25, 4.75, and 6.5 inches long, respectively.

A specimen 2.62 inches long has the pectorals dark, almost black; anal anteriorly dusky; caudal dusky at base, and a conspicuous black spot about the middle of the dorsal.

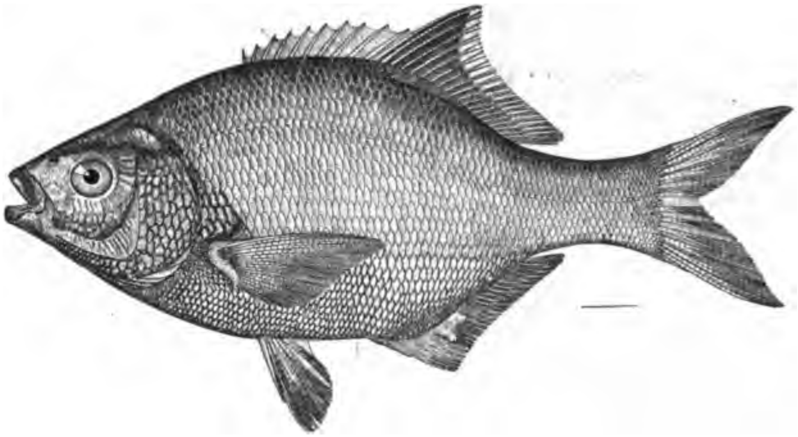


FIG. 28.—Damalichthys argyrosomus (Girard).

Family 30. SCORPÆNIDÆ. The Scorpion-fishes.

69. **Sebastolobus alascanus** (Bean).

The collection contains 11 specimens of this species, the localities represented being stations 4238 to 4241 (Behm Canal) and 4302 (Sumner Strait, off Shakan). The depths range from 169 to 256 fathoms. The specimens range in length from 3.4 to 23 inches.

Dorsal XVI in 8 specimens, XVII in 3. In two small examples (3.4 and 5 inches total length) the black spots on the spinous dorsal are quite distinct and the pectorals are marbled with black and white. The ventrals also are dusky, and the soft dorsal of the smaller specimen is dusky, and has 3 or 4 small roundish white spots. Two adults (nos. 2878 and 2879) taken at station 4238, in Behm Canal, were, in life, bright rose-red all over, paler below, especially on lower parts of head; fins all red; caudal with some black on outer parts of membranes; pectoral also with some black on interradial membranes; inside of opercle rose-color.

Originally described by Bean (1891) from Albatross station 2853, off Trinity Islands. Recorded also by Gilbert (1895) from stations 3227, 3324, 3330 to 3332, and 3337 to 3340, in Bering Sea, north of Unalaska Island, or in the north Pacific, southeast of Unimak Island.

This species reaches a length of 2 feet or more. Its range extends from California to Bering Sea. It is usually found in rather deep water, 100 to 800 fathoms. Its flesh is palatable and the species should be of some value as a food fish.

70. **Sebastolobus altivelis** Gilbert.

Originally described by Gilbert (1895) from station 3338, south of the Alaskan Peninsula. No other specimens have been taken in Alaskan waters, but it has been found to be almost equally abundant with *S. alascanus* off the coast of California as far south at least as San Diego, in relatively deep water. It reaches a foot in length.

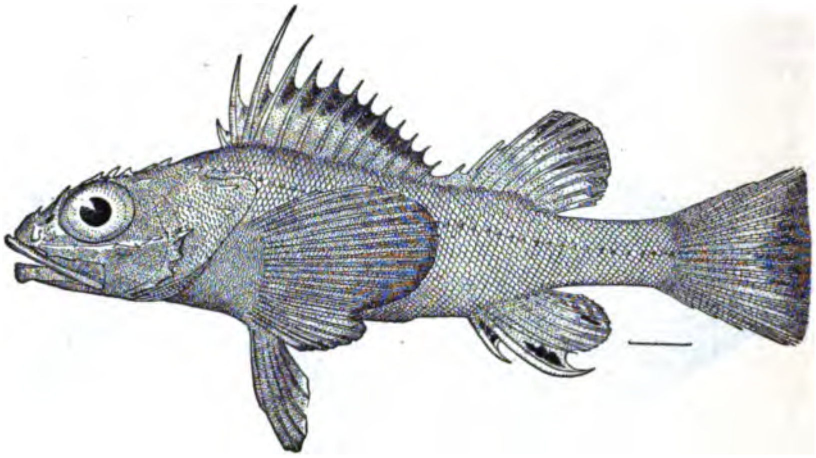


FIG. 29.—Sebastolobus altivelis Gilbert.

71. **Sebastodes paucispinis** (Ayres). *Boccacio.*

This species occurs from San Diego to Barclay Sound, British Columbia, in rather deep water. We have one specimen 8 inches long, from Barclay Sound, collected by the *Albatross* September 27, 1888. The species reaches a length of 2.5 feet and a weight of several pounds.

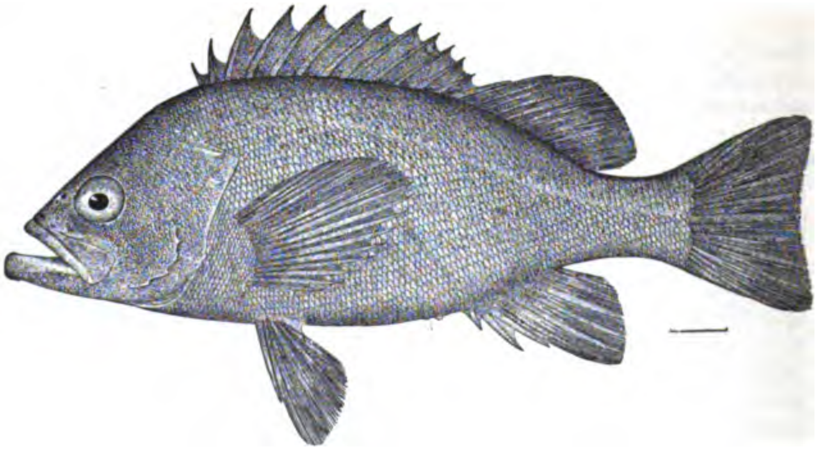


FIG. 30.—Sebastodes melanops (Girard).

72. **Sebastodes melanops** (Girard). *Sitka "Black Bass."*

This species was obtained at Nanaimo, in the surface tow-net, at Sitka, Naha Bay, and Port McArthur with hook and line, and by Mr. Rutter at Karluk. Four specimens were seined at Metlakahtla, and several were seen at Shakan. They range in length from 6.5 to 15.25 inches. We have examined also an example 8.5 inches long collected by the *Albatross* at Barclay Sound, British Columbia, September 23, 1888, and also 2 specimens 7.5 and 8.5 inches long collected in 1893 at St. Paul, Kodiak, and 7 others 6 to 13.5 inches long collected in 1897 at Redfish Bay and Hunter Bay.

The range of this species is from Monterey Bay to Kodiak Island, it being most abundant northward. It reaches a length of 18 to 20 inches. Bean (1882) has recorded it from Sitka and St. Paul, Kodiak.

These fish take the hook freely and afford some sport as game fish. At Sitka July 28 they were biting well and many were caught from the wharf. Pieces of meat were used for bait and the fish were found in water 6 to 18 feet deep. They usually take the hook rather quietly and at first make a pretty good fight, but soon give up and allow themselves to be lifted out of the water without much struggle. They are therefore a "boy's fish," which will not appeal strongly to the experienced angler, but they are good food fish and bear a certain resemblance to the black bass (*Micropterus*). Color in life, olive-brown, blotched with dirty red.

73. **Sebastodes ciliatus** (Tilesius).

Two specimens, 3.75 and 7.25 inches long, from station 4285 in Chignik Bay. These have 14 dorsal spines each. In all other respects they agree perfectly with a large specimen (no. 2865), 13 inches long, taken with hook and line at Loring, July 7. We have also 3 specimens 12 to 13.5 inches long collected by the *Albatross* in 1897 at Redfish Bay and Killisnoo. The species is now known from Kodiak Island, Aleutian Islands, Chignik Bay, Loring, Mary Island, Tolstoi Bay, Nakat Harbor, and Port Chester.

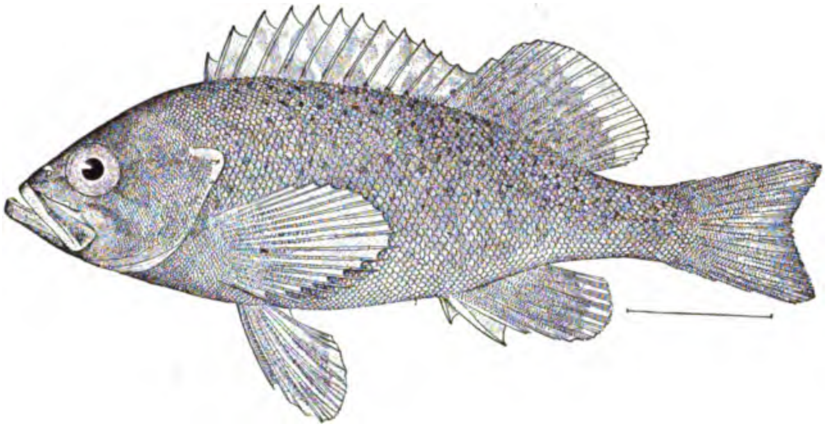


FIG. 31.—Sebastodes ciliatus (Tilesius).

As our 13-inch specimen is more than twice the size of those upon which current descriptions were based, we give the following notes on it: Head 3.2 in length; depth 2.8; oblique rows of scales 60, plus a few small scales on base of caudal fin; pores 50; eye 4 in head, equaling snout; interorbital width about equaling eye; fifth dorsal spine 2.75 in head.

Our examples have been compared with the 3 small specimens from Kodiak in the National Museum and one 7.5 inches long collected by the *Albatross* at Kodiak Island, August 14, 1888, with which they agree.

Epinephelus ciliatus Tilesius, Mem. Ac. Sci. St. Petersb., IV, 1810, 474, "Camtschaticus et Americanus": no definite locality given, probably from about Kodiak Island.

Perca variabilis Pallas, Zoogr. Rosso-Asiat., III, 241, 1811, Aleutian Islands. (Type in museum of Berlin: red examples of *S. aleutianus* included as the summer coloration.)

74. **Sebastodes mystinus** Jordan & Gilbert. *Black Rockfish.*

One specimen (no. 1670) 14 inches long, collected by the *Albatross* at Attu Island in 1893, and 2 others (no. 2165 and 2166), each 15 inches long, collected by the same vessel at Killisnoo. The species ranges from the Aleutian Islands to San Diego, and about San Francisco is the most abundant of the family. It occurs in shallow water and reaches a length of about 14 inches.

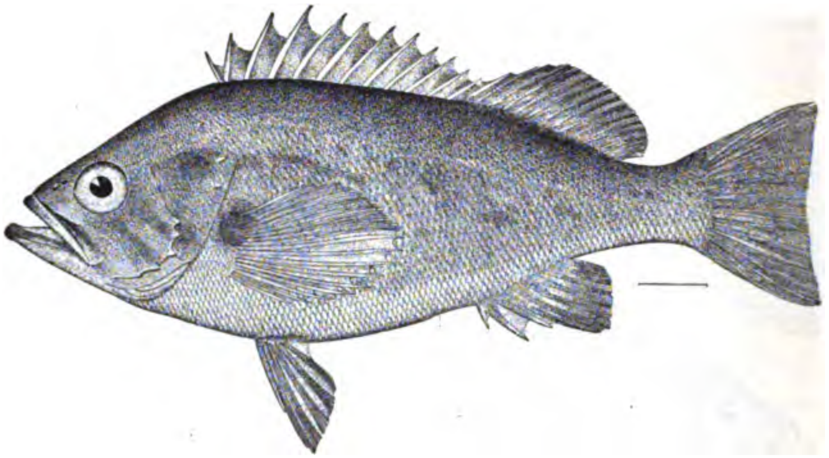


FIG. 32.—Sebastodes mystinus Jordan & Gilbert.

75. **Sebastodes brevispinis** (Bean).

One fine specimen 14½ inches long (no. 2864), taken on hook at Loring by Mr. F. M. Chamberlain in July. Dorsal XIII, 14; anal III, 7; 61 pores in lateral line; only the nasal, preocular, and parietal spines present; mandible apparently naked; gillrakers 10 + 25, the longest 1.75 in eye.

The collection contains also 4 other specimens which we refer to this species, seined at Metlakahtla, July 10. They are each about 4 inches in length and agree in all essentials with the large specimen.

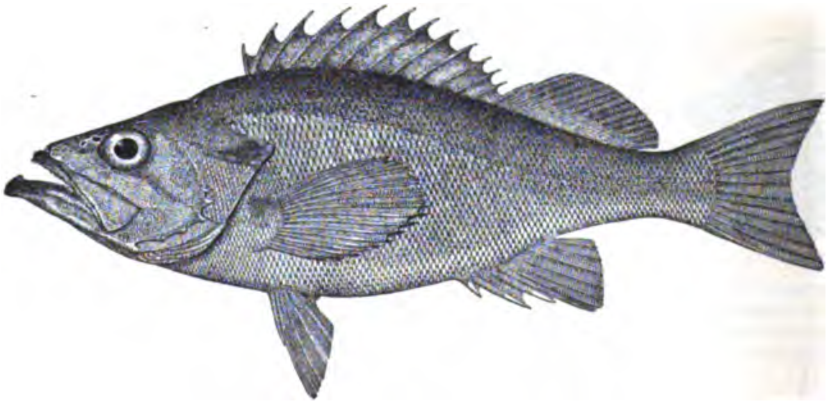


FIG. 33.—Sebastodes brevispinis (Bean).

Each of them, however, shows a very distinct black spot on the membranes of the ninth to thirteenth dorsal spines; colors otherwise agreeing with the large examples.

Originally described by Bean (1884) as *Sebastichthys proriger brevispinis* from Hassler Harbor.

This is a rare species, as yet known only from the type and the 5 specimens here recorded.

76. **Sebastodes alutus** Gilbert.

The collection contains 20 specimens of this species, representing the following localities: Dredging stations 3486, 3489, 3490, 3449, 3459, 4223, 4227, 4228 (4 specimens), 4249, (tag no. 2898), 4253 (tag no. 2905), 4283, 4284 (3 specimens), 4285, 4289 (5 small specimens and one large example no. 3000), 4290 (tag no. 2995), and 4292. These specimens range in length from 4.4 to 15 inches. We have also examined 8 small specimens 3 to 5 inches long dredged among the Santa Barbara Islands at station 2840, and 2 specimens (paper tag no. 110 and 111), each about 4.5 inches long, from Albatross station 3599, June 9, 1894, in Bering Sea. These specimens had a number of parasites upon them.

All these specimens agree in the main with the excellent original description of the species. Specimen no. 2898, 9.25 inches long, from Eastern Passage (vicinity of Stikine River Delta), shows some differences, the body being more slender, the eye larger, snout longer, maxillary longer, and the mandible more projecting. It gives the following measurements: Head 2.75; depth 3.5; eye 3.1; snout 4.4; maxillary 2.1; dorsal xiii, 15; anal iii, 8; gillrakers 10 + 28.

The young differ somewhat from the adult. The following detailed description is based on a specimen (no. 97) 4.5 inches long from station 4285: Head 2.8 in body; depth 3.5; eye 3.1 in head; maxillary 2.2; mandible 1.8; snout 4; interorbital 4.8; dorsal xiii, 15; anal iii, 8; ventrals i, 5; pectorals 18; pores 47+1 on tail, about 51 transverse series of scales.

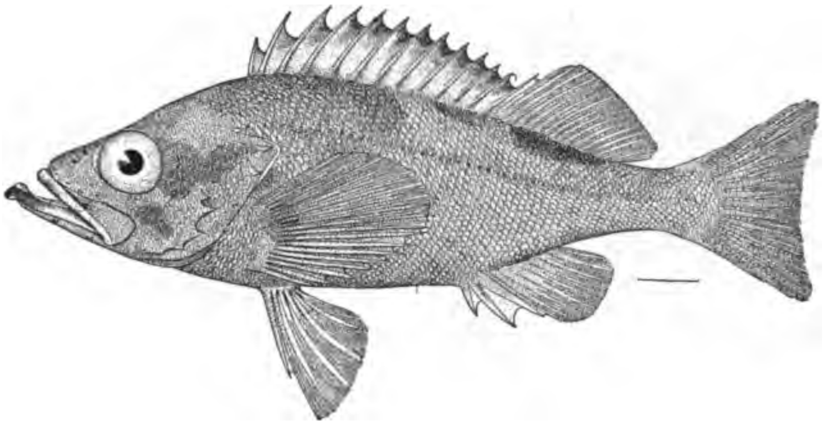


FIG. 34.—Sebastodes alutus Gilbert.

Body ovate, compressed, both dorsal and ventral outlines gently curved; head moderate; mouth medium, slightly oblique, the tip of premaxillary on a level with pupil, the gape extending to under nostril; maxillary extending to a little beyond vertical at middle of orbit; mandible to posterior margin of pupil; teeth minute, in narrow bands on palatines, a triangular patch on vomer, bands on upper jaw terminating anteriorly in rounded lobes, leaving a vacant space at symphysis, the teeth each side of vacant space slightly enlarged; band on lower jaw narrow, the symphyseal patch somewhat raised and its teeth somewhat enlarged, this patch fitting into the vacant space above; lower jaw slightly projecting, entering profile, a small symphyseal knob; tongue rather large, fleshy, acute; buccal cavity rather pale; interorbital space tolerably broad, 1.5 in eye, and very slightly concave; cranial ridges rather sharp and tolerably well defined, the following spines present: nasal, preorbital, supraorbital, postorbital, tympanic and parietal, all these small, but stout and sharp; a stout humeral spine; opercular spines two, triangular, united at base; preopercular spines five, rather stout. Scales on jaws, cheeks, and occiput, a barren patch above suborbital stay; scales on body very weakly ctenoid, as are those on occiput; scales on jaws, cheeks, and breast cycloid. Dorsal fin rather low, its longest (fifth) spine 2.45 in head, longest ray about 3 in head (probably broken); base of fin about 1.8 in body, its origin above tip of opercular flap; distance from tip of snout to origin about 2.9 in body; fin membranes somewhat incised, leaving about one-third of the spines exserted; border of fin not deeply emarginate; anal not high, length of longest ray 2.1 in head, the base the same length; second anal spine longest, not conspicuously stouter than others, its tip reaching slightly beyond tip of third spine but not to tip of nearest rays; ventrals rather narrow, acute, length 1.6 in head, tips not reaching vent by quite a perceptible distance; pectorals rather broad, acute, 1.25 in head, tips reaching nearly to vent, lower 9 rays very slightly thickened, not branched, upper rays branched; caudal 1.55 in head, apparently truncate; gill cavity somewhat dusky; gillrakers 11 + 25, rather long and slender, 1.9 in eye; peritoneum black.

Color in alcohol, light yellowish-brown above, somewhat silvery below; occiput, line along base of dorsal, and spot on opercle dusky; dorsal more or less dusky, the edge of the membrane blackish.

77. **Sebastodes pinniger** (Gill). *Orange Rockfish.*

One specimen 5 inches long from station 4220 in Admiralty Inlet, July 1. It is a female with well advanced eggs.

Head 3.25 in body; depth 3; eye 3.5 in head; maxillary 2.1; dorsal XIII, 14; anal III, 7; scales 45.

A specimen 4.5 inches long from station 4193. Dorsal XIII, 14; head 3; eye 3; gillrakers 12 + 26, long and slender.

Another example 3.5 inches long from station 4205.

This species reaches a length of 2 feet or more and ranges from San Diego to Puget Sound.

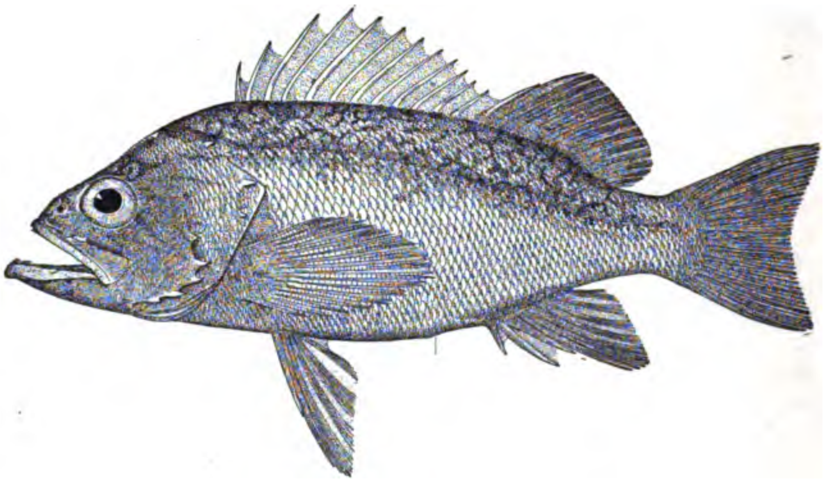


FIG. 35.—Sebastodes pinniger (Gill).

78. **Sebastodes aleutianus** Jordan & Evermann. (Pl. XVI.)

This species is certainly known only from the type locality. Shelikof Strait, off Kodiak Island.

79. **Sebastodes saxicola** (Gilbert).

Two specimens 2.5 and 2.75 inches long seined at Metlakahtla, and 3 others, 2.5, 4.25, and 6 inches, dredged at station 4228 (Naha Bay).

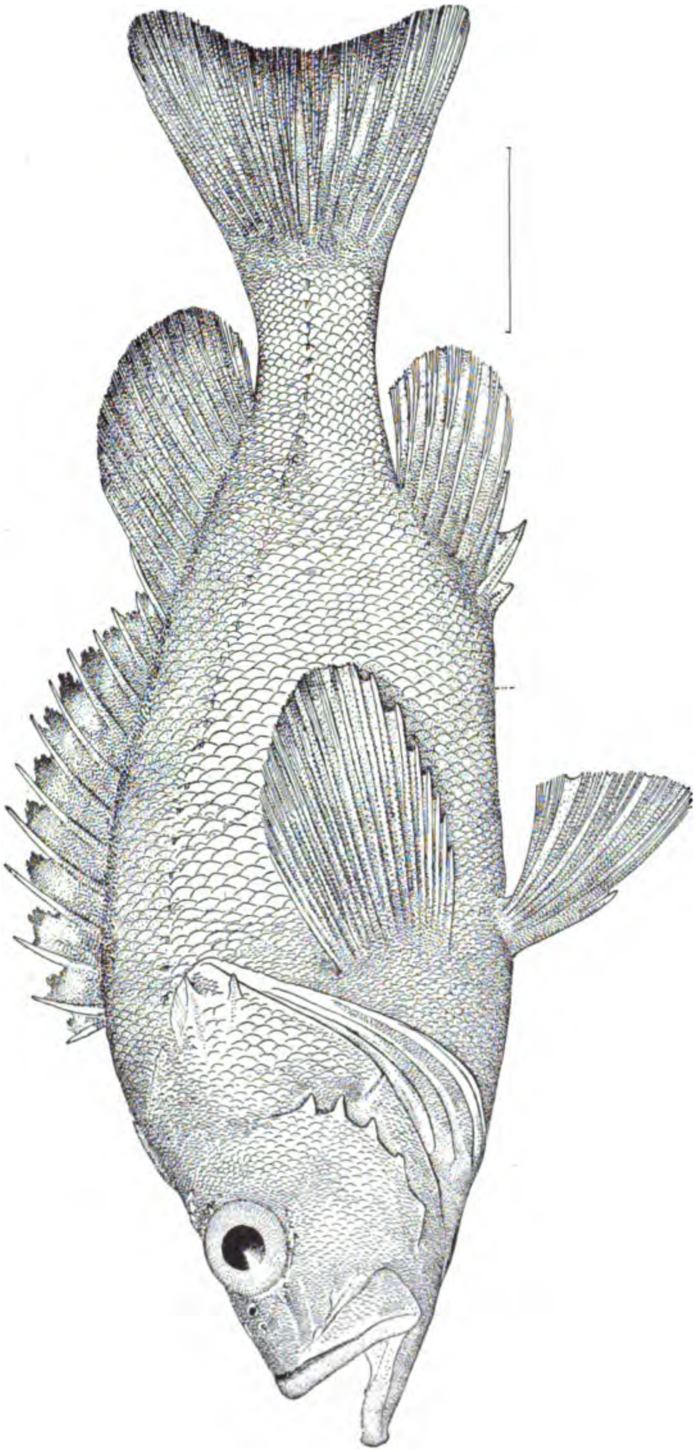
Head 3; eyes 2.75; snout 4; interorbital 4; pores 43; scales about 50; dorsal XIII, 14; anal III, 7; gillrakers 11+23, long and slender, 2 in eye.

An example 9 inches long from station 3129, off the coast of central California, March 13, 1890, has the head 2.75; snout 4.25; depth 3.2; gillrakers 10+23, 2.1 in eye; eye 3.2. Longest dorsal spine 2.5 in head.

Another example (paper tag no. 102), from Barclay Sound, had the gillrakers 9+22, long and slender, 2.2 in eye.

We have compared our specimens with others in the National Museum and find them identical.

This fish ranges from southern California to southeast Alaska in waters of moderate depth. It reaches a foot in length.



SEBASTODES ALEUTIANUS JORDAN & EVERMANN. TYPE.

80. **Sebastodes swifti** Evermann & Goldsborough, new species.

Head 2.65 in body; depth 3.1; eye 3.2 in head; snout 4.2; maxillary 2; mandible 1.8; interorbital about 2 in eye, 6 in head; dorsal XIII, 13; anal III, 7; scales 42 in oblique series, about 32 pores.

Body oblong-ovate, compressed, the dorsal and ventral contours gently curved, the dorsal sloping rather gently both ways from the nape; caudal peduncle rather slender, its least depth 1.15 in eye; head large, bluntish; interorbital space rather narrow, somewhat concave, a pronounced ridge inside of each supraocular ridge; nasal, preocular, supraocular, postocular, tympanic, parietal, nuchal, and coronal spines all present, rather strong; preorbital narrow, with two broad flat lobes on the upper half; two broad flat humeral spines; opercular spines strong, somewhat diverging; preopercular spines moderately strong, the second longest, the first, second, and third projecting backward, but somewhat diverging, the fourth and fifth short and blunt, projecting downward and backward, all about equally spaced; teeth in rather narrow villiform bands on both jaws and palatines, a triangular patch on vomer; the band of teeth on upper jaw broadening to rounded lobes anteriorly, leaving a small, naked interspace at the symphysis into which the symphyseal knob of the lower jaw fits; the tongue small, short, and broadly rounded; maxillary reaching vertical at posterior edge of pupil, its width at the tip 2 in eye; lower jaw scarcely projecting; the mouth somewhat oblique; premaxillary on a level with lower edge of pupil; gillrakers 8+21, rather long and slender, the longest about 2 in eye. Dorsal long, its origin a little in front of the rounded opercular flap, the distance from tip of snout to origin of dorsal equaling the length of head; base of dorsal about 1.8 in length of body; dorsal spines moderately strong, curved, the longest about equaling distance from tip of snout to middle of pupil; dorsal rays somewhat shorter; notch between spinous and soft dorsal not pronounced; second anal spine strong, curved, about equaling the third in length; ventrals short, not reaching vent; pectorals long, reaching vertical at vent; scales rather adherent, finely ctenoid; top of head, opercles, cheek, and maxillary scaled; mandible naked.

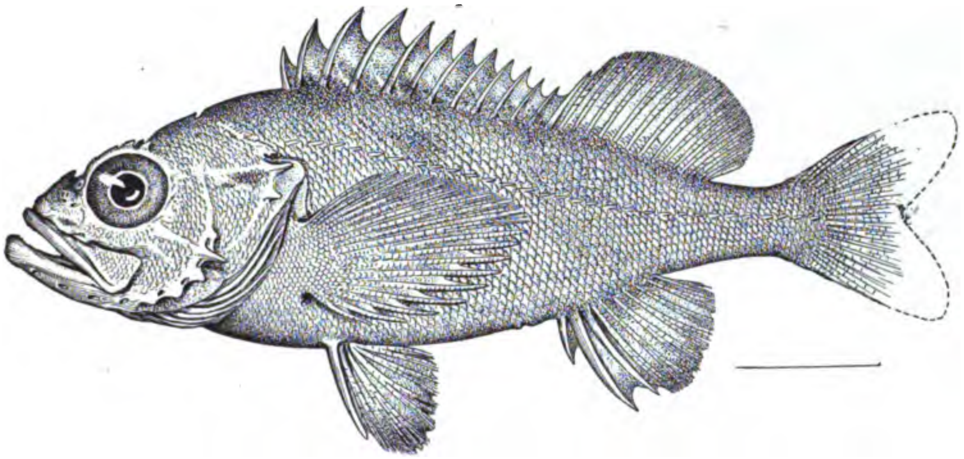


FIG. 36.—Sebastodes swifti Evermann & Goldsborough, new species. Type.

Color in alcohol, pinkish-brown, with indistinct, dusky, black patch above lateral line; cheek somewhat dusky, a black patch on upper edge of opercle and a smaller one at lower end; axil black; dorsal, anal, caudal, and ventrals tipped with black; inside of mouth pale; under side of opercle posterior to pseudobranchiæ with a black patch.

This species appears to be related to *Sebastodes crameri*, from which it differs in the narrower and more concave interorbital, the stronger ridges on the head, the stronger cranial spines, the presence of coronal spines, the smaller eye, the longer maxillary, the less strongly arched body, and the fewer pores in the lateral line.

Our collection contains two specimens—the type, no. 57821, U. S. National Museum (field no. 2872), 6.25 inches long, from Albatross station 4234 in Yes Bay, Alaska; and the cotype, no. 2893 (no. 5228, Bureau of Fisheries), 3.5 inches long, from Albatross station 4246, Kasaan Bay, Alaska.

This species is named in honor of the late Lieut. Franklin Swift, U. S. Navy, the efficient commander of the *Albatross* during the Alaska investigations in 1903.

81. **Sebastodes diploproa** (Gilbert).

The collection contains 2 small specimens (no. 2784 and 2785), 3.25 and 3.5 inches long, dredged at station 4191, in Nanaimo Harbor, June 19. We have also examined a specimen (no. 101) 6.75 inches long, collected by the *Albatross* in 1890, probably off the California coast.

No. 2784 in life was light red, brownish on back, coppery on head; belly below lateral line abruptly silvery, scarcely washed with red; back with 5 obscure dull orange saddles, very diffuse, extending below lateral line, the one below soft dorsal broadest; head all red, the opercle with many dark dots; dorsal red, slightly orange shaded, pinkish at tips, the soft dorsal with a black cross-blotch about halfway up from behind third to sixth soft ray; black on membranes, not on rays; caudal faint orange, base reddish, tips pale; anal like soft dorsal, the black blotch fainter, larger, from behind second spine to third soft ray; pectoral and ventral pinkish-red; inside of mouth red; gill-cavity white; peritoneum black.

Head 2.75 in length; depth 3.1; eye 3.3 in head; snout 5.1; maxillary 2.25; mandible 1.9; interorbital 1.5 in eye, 4.5 in head; dorsal XIII, 12; anal III, 8; pores in lateral line 34 to 41. Nasal, preocular, postocular, tympanic, and parietal spines present, all well developed; preorbital with 2 blunt diverging spines; 2 small humeral spines; gillrakers 11+23, long and slender, 2 in eye.

No. 2785 has more black on second dorsal, less on anal; membranes of spinous dorsal dusky edged; a little dusky on upper edge of opercle; general color light brick red, the belly abruptly silvery.

These specimens have been compared with the types in the National Museum, with which they are found to agree.

The species reaches a length of a foot or less, and occurs on our Pacific coast from the Coronado Islands northward to Nanaimo.

82. **Sebastodes introniger** (Gilbert).

One small specimen 2.75 inches long, dredged at station 4243, in Kasaan Bay, agrees in most respects with the original description of this species.

Head 2.75; eye, 2.75; dorsal XIII, 14; anal III, 6; scales about 45, 31 pores; gillrakers 8+20, rather long and slender, 2 in eye.

Four specimens, 3.85 to 4.75 inches long from station 4223, in Boca de Quadra. These do not show the black gill-cavity and mouth which *introniger* is said to have. We have one other specimen, no. 1088, 20 inches long, dredged at station 3324, Bering Sea, August, 1890. The species has also been recorded from Bering Sea at stations 3311, 3317, 3324, and 3331 (Gilbert 1895). The known range of this fish is from Santa Barbara to Bering Sea, in waters of moderate depth.

83. **Sebastodes ruberrimus** Cramer. *Red Rock Cod; Red Rockfish.* (Pl. XLII.)

The collection contains 1 large specimen (no. 2868) 12 inches long from Boca de Quadra, where it was caught on hook and line, July 5, at a considerable depth. When brought to the surface its stomach had been thrown out into its mouth. This specimen agrees with current descriptions. (The colored painting was made from life, from an example about 2 feet long, taken at Loring, where the species is not uncommon.)

Gillrakers 9+18, short, rough, clavate, 3 in eye, first 5 on short arm and last 7 on long arm mere tubercles. Head 2.6; depth 2.6; eye 4.5; dorsal XIII, 15; anal III, 7; scales 50, pores 44; maxillary 2.1; mandible 1.66.

We have also 3 specimens 18, 19, and 14 inches long, collected respectively at Hunter Bay, Mary Island, and Mink Arm, and a specimen 19 inches long collected in Union Bay. The species has been recorded by Bean (1882), as *Sebastichthys ruber*, from off Point Bingham; Jacobi Island; Gulf of Alaska; and Kygani Strait.

The red rockfish is one of the largest of the family. It attains a length of more than 2 feet and a weight of many pounds. As a food fish it is of considerable importance, the flesh being fairly firm and of good flavor, and it takes the baited hook freely and possesses some game qualities. It is known to occur from San Diego to Boca de Quadra and Loring in southeast Alaska in moderate depths.

84. **Sebastodes rosaceus** (Girard). *Orange-red Rockfish.*

Two specimens (no. 2822 and 2823), 5.2 and 9 inches long, seined near Marrowstone Point, June 29, and 1 example (paper tag no. 105), 9.5 inches long, collected by the *Albatross* at station 2887, off the coast of Oregon, October 19, 1888.

The membranes of the dorsal and anal fins are deeply incised, being very different from all other species with which we are acquainted. In the soft dorsal and anal the interradial membranes do not reach more than two-fifths of the length of the rays. We have compared our specimens with 9 others from Santa Barbara and find that some of the latter show the same structure, though the majority show little or no incision of these membranes.

This species reaches a length of a foot or more and is a good pan fish. Its range extends from San Diego to Puget Sound.

85. **Sebastodes rupestris** (Gilbert).

The collection contains 3 specimens 4.75 to 6 inches long (nos. 2906–8) from station 4253, in Stephens Passage, and one 6 inches long from station 4231 in Behm Canal. The last specimen has 14 spines in the dorsal, but in all other respects it agrees with the other specimens. Maxillary in all three specimens reaches to posterior margin of pupil; gillrakers 9 +16 (+4 tubercles), more numerous than usually given in descriptions.

Comparison of our specimens with the types shows no imporant differences. The black on the fins in the types has faded, while in ours it is still very distinct. Ours also have a large dark opercular spot not mentioned in the description of the types. We have also compared our specimens with the types of *Sebastichthys aurora* and find them to agree fully. We are unable to discover any characters by means of which they can be distinguished, and are therefore compelled to unite these two nominal species. *S. rupestris* as here understood ranges from the Santa Barbara Islands northward to Southeast Alaska (Stephens Passage and Behm Canal).

Sebastichthys rupestris Gilbert, Proc. U. S. Nat. Mus., XIII, 1890 (July 1), 76, Albatross station 2946, in 150 fathoms off southern California.

Sebastichthys aurora Gilbert, Proc. U. S. Nat Mus., XIII, 1890 (July 1), 80, Albatross stations 2948 and 2960, in 266 and 267 fathoms, off southern California.

86. **Sebastodes dalli** (Eigenmann & Beeson).

A single specimen (no. 2820), 8 inches long, taken on hook at Union Bay, June 23. It appears to agree with *S. dalli*, except that the maxillary is closely scaled on the posterior half.

Gillrakers 7+18, longest 2 in eye, the first 5 on the short limb blunt and rough-tubercular. the last 8 on the long arm similar. Scales 61 or 62, about 45 in oblique series along lower portion of side; head 3; depth 3; eye 4.5; snout 4.5; interorbital a little less than eye.

Dorsal 13; anal 6; dorsal spines 1.75 in head; nasal, postocular, preocular, tympanic, and parietal spines present; coronal spine on right side and nuchal spine on right side present; a small humeral spine present; preorbital with one broad spine. Mandible naked; maxillary closely scaled on posterior half.

The only specimens previously known are the type (from San Francisco) and another from Vancouver Island.

87. **Sebastodes caurinus** (Richardson).

We have 15 specimens 2 to 5.5 inches long collected by Osgood and Heller at Queen Charlotte Island, July, 1900; one specimen (no. 1820), 10.5 inches long, collected in 1895 in Klemtoo Harbor; one 11.5 inches long obtained by the *Albatross* at Sitka in 1896; one 9.5 inches long by Luttrell at Sitka; one 20 inches long collected at station 3449, off Washington; 19 specimens collected near Seattle in 1903 by

Mr. J. E. Todd, and 2 by Mr. Chamberlain at Dolomi in 1903. The species has also been recorded by Bean (1882) from Old Sitka and Chacon and (1884) from Mary Island. It was described originally from Sitka.

Interorbital flat; gillrakers 9 + 19, the longest 2 in orbit, the last six on lower limb mere tubercles, the first four on vertical limb short, rough, and somewhat clavate.

Sebastodes caurinus, Osgood, North American Fauna No. 21, September 26, 1901, p. 20 (Queen Charlotte Islands).

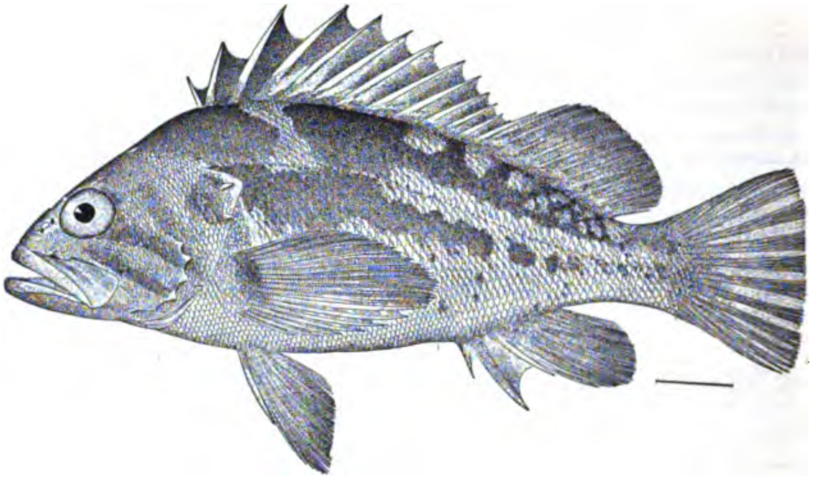


FIG. 37.—Sebastodes caurinus (Richardson).

88. **Sebastodes maliger** (Jordan & Gilbert). *Yellow-backed Rockfish.*

Two specimens (nos. 108 and 109), 6.5 and 7.5 inches long, seined at Union Bay, June 22, and 2 caught on hook at same place June 23; also 2 (nos. 2954 and 2955), 8.5 and 9.5 inches long, taken on hook at Sitka, July 28; 5 specimens, 12.5 to 14 inches long, were taken by the *Albatross* at Mary Island; and a single specimen 13 inches long at Klemtoo Harbor in 1895. Two other specimens, one taken by Luttrell at Sitka and one by H. C. Fassett at Klawak. These all agree well with specimens in the National Museum. No. 2954 may be described as follows:

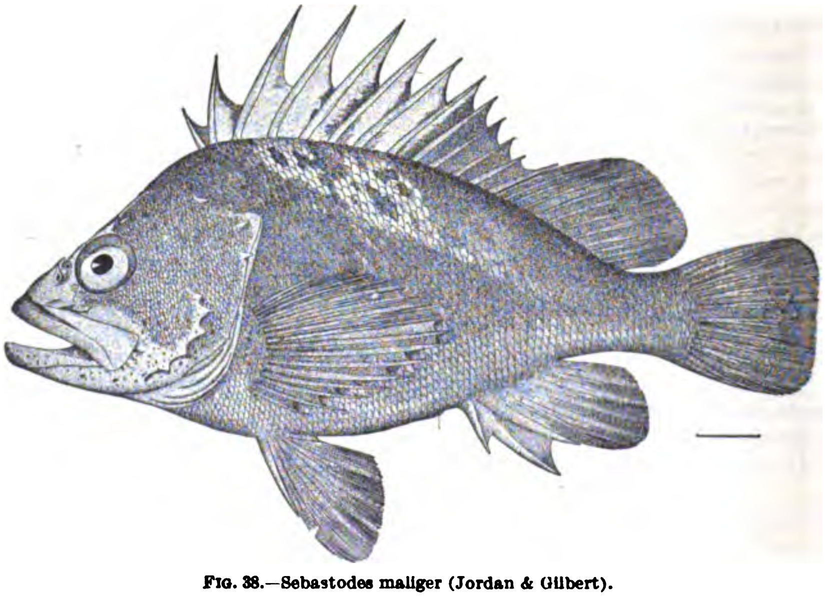


FIG. 38.—Sebastodes maliger (Jordan & Gilbert).

Head 2.9; depth 2.9; eye 4; snout 4.1; maxillary 2; mandible 1.9; interorbital 5.25; dorsal xiii, 12; anal iii, 6; gillrakers 8 + 19, rather stout, longest 2.75 in eye; scales 57, pores 48; longest dorsal spine 1.8 in head; longest dorsal rays 2.1 in head. In other specimens the gillrakers were 10 + 21 or 10 + 19.

Body short, stout, and deep; mouth slightly oblique, lower jaw not projecting, maxillary nearly reaching posterior border of orbit; mandible and maxillary not scaled; nasal, preocular, postocular, tympanic and parietal spines present; nuchal, coronal, and supraocular spines absent; preorbital with 2 broad, low points, not spine-like.

This species is known to range from Monterey to Sitka in rather deep water, being abundant northward. It reaches a length of about 2 feet. It was also recorded from Sitka by Bean (1882) as *Sebastichthys maliger*.

89. **Sebastodes nebulosus** (Ayres).

A small specimen (no. 112), 2.5 inches long, from station 4204, off Fort Rupert. We have also 2 others, 11 and 12 inches long, taken by Mr. H. C. Fassett at Klawak in 1905. Bean (1884) records it from Mary Island. The following measurements are taken from the small example from station 4204:

Head 2.75; depth 3.6; eye 2.9; dorsal xiii, 13; anal iii, 6; scales 45 to 47, about 42 pores; gillrakers long and slender; nasal, preocular, postocular, tympanic, and parietal spines present. The color, however, does not exactly agree with that given for this species. Our specimen in alcohol is clayey white, mottled with large, irregular brown blotches, about 4 along side above lateral line, 2 or 3 immediately below it, and 3 along lower part of side; spinous and soft dorsals similarly mottled.

90. **Sebastodes nigrocinctus** (Ayres). *Black-banded Rockfish.*

Two specimens, 13 and 14 inches long, taken by Mr. H. C. Fassett at Klawak in 1905, and one specimen (no. 2863), 12 inches long, taken by Mr. Chamberlain on hook and line at Naha Bay, Loring, July 7, 1903, where he states that the species is common. This specimen gives the following measurements:

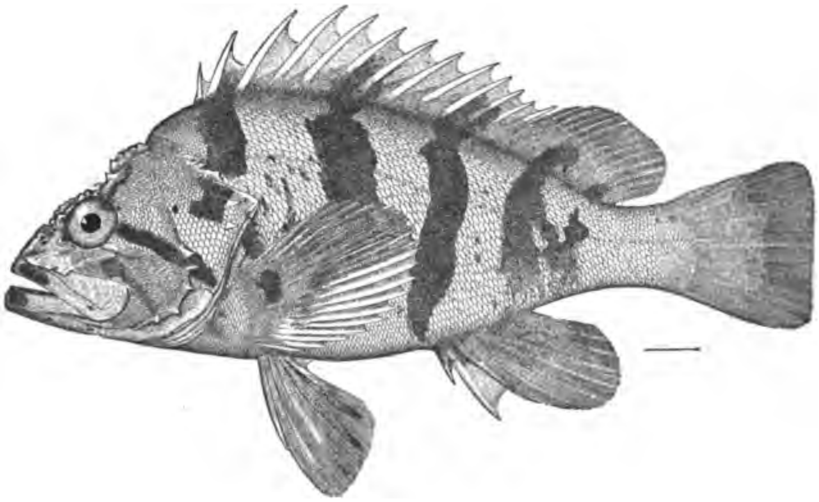


FIG. 39.—Sebastodes nigrocinctus (Ayres).

Head 2.65; depth 2.67; eye 4; dorsal xiii, 14; anal iii, 7; scales 52; pores 44; snout 4.5; gillrakers 9 + 21, stiff, rough, clavate, the longest 3.5 in eye, the terminal ones of each arm reduced to tubercles. It differs from typical examples in the following respects: There is a small supraocular spine on the left side; the mandible is pretty well covered with very minute, thin cycloid scales; the nuchal spines coalesce with the parietal.

Color in life: Body blood red; cheek with a black stripe downward from front of eye to lower edge of cheek; another from eye backward and downward to branchiostegals; a large black blotch on upper part of opercle; a broad black bar from front of dorsal downward to opercle, connecting with black opercular blotch; another and much broader from fifth to seventh dorsal spine nearly vertically downward to belly; another from ninth to twelfth dorsal spine to vent; two others from soft dorsal to soft anal, these fusing below; fins all red, the dorsal and anal encroached upon by the black sidebars; a short black area behind eye; base of pectoral blotched with blackish.

This species reaches a length of 2 feet or more and is known to range from Monterey Bay to Naha Bay. Recorded (1884) by Bean from Mary Island.

Family 31. ANOPLOPOMATIDÆ.

91. **Anoplopoma fimbria** (Pallas). *Black Cod.*

The black cod, coalfish, beshow, or skil, as it is variously called, occurs on our Pacific Coast from Monterey Bay to the Aleutian Islands. It was taken by the *Albatross* at station 2869, in 1888, at Cordova Bay in 1897, and at Loring, Pyramid Harbor, and Taku Harbor in 1900. One specimen from each place is in the collection. Bean, in 1882, records it from Sitka and Wrangell and in 1884 from Hassler Harbor. We also have one specimen (no. 02825), 14 inches long, taken with hook and line over the rail off Fort Rupert (1903).

This species is known at Loring and Taku as black cod; at San Francisco it is called candle-fish, and on Puget Sound, horse mackerel; it is sometimes sold in the markets as Spanish mackerel; in the Straits of Fuca it is known as beshow by the Neah Bay Indians. It is found usually in rather deep water and is perhaps most abundant in the Puget Sound region. It is seen oftener in the Seattle markets than in those of any other place. It attains a length of 18 to 20 inches and a weight of 5 pounds.

As a food fish it occupies only a moderate rank, the flesh being rather dry and tasteless. On Puget Sound, however, where it reaches a larger size and is fatter than elsewhere, it is more highly esteemed, particularly by the Indians. It is said to feed on crustaceans, worms, and small fishes. As a game fish it is not without interest, taking the hook readily and making a fair fight. It can be taken with cut bait at depths from 2 to 15 fathoms.

Family 32. HEXAGRAMMIDÆ. The Greenlings.

92. **Pleurogrammus monopterygius** (Pallas). *Atka Mackerel; Atka-fish.*

This interesting fish occurs in the North Pacific, chiefly among the Aleutian Islands. It was described originally by Pallas in 1810 from specimens obtained at Unalaska. Its center of abundance seems to be in the passages about the islands of Atka and Attu. It is known also from about the Pribilof Islands and eastward through the Aleutian Chain to Belkofski and the Shumagins. Stejneger found it at Saranskaya, Bering Island. Bean (1882) has recorded it from Unalaska, Chernofski, and Attu; Turner (1886) found it at Unalaska, Amlia Pass, Captains Harbor, Atka, and Attu; Gilbert (1895) lists it from Unalaska; and Evermann found it in abundance during the last week of May (1892) at Atka and Attu.

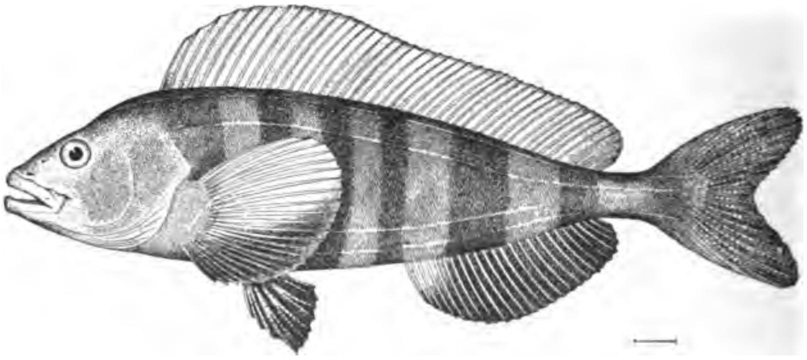


FIG. 40.—Pleurogrammus monopterygius (Pallas).

The best account of the habits of this fish is that given by Turner. It is so interesting and instructive that its republication, with some slight modification, is justified. Turner says: [a]

When I arrived at Unalaska in 1878 I heard much talk about the "mackerel." During the summer of that year I had an opportunity of conversing with those who frequented the western islands of the Chain, where these fish were said to abound. Several persons referred to these fish as "Spanish mackerel," others called them "horse mackerel" and "Alaskan mackerel," and under several scientific names. They were served at the table on several occasions, and all who ate of them highly praised their good qualities and spoke of their great resemblance in taste to the Atlantic mackerel. It was not until in May, 1879, that I had an opportunity of visiting the locality where they were said to be abundant.

During the summer of 1879 I was at Atka Island, and soon made inquiry concerning the fish. I was told that they make their appearance in the narrow pass between the islands of Atka and Amlia about the 1st of June, and that the fish invariably come from the Pacific Ocean, which here mingles its waters with that of Bering Sea.

The first arrivals of fish are the males of largest size and beauty of color. They arrive a few days before and await the arrival of the females and immature males.

By the 18th of June the fish have come in countless thousands. They arrange themselves with their heads toward the tide currents which rush violently through the pass. The flood tide sets in from the Pacific, while the ebb flows toward the Pacific, or, in other words, a southerly directed current for the ebb and a northerly directed current for the flood tide. The pass is very rocky, with numerous sunken rocks in the middle and on the eastern side. The western side of the pass has the deepest water and is 3 fathoms deep in the channel. On the north side of the pass numerous ledges of rocks, hidden rocks, kelp patches, and small islets of but few feet above the water's edge are to be found. It would be very difficult navigation for a vessel of over 20 tons to go through there with safety. The natives of the present day cross pretty well to the north side of the pass until they get under Amlia Island and then run near the shore of Amlia with their small bidari or open boats.

Among the seaweeds or kelp patches on a cloudy day of clear lower atmosphere the fish may be seen in the following order:

The young males and immature females form a stratum of three or four fish deep and several feet wide; beneath these a second stratum of older males and females, whose roe is not yet developed, and will later, in the spawning season, take their place with those in the third stratum, which is composed of vigorous males and females. The latter are the most abundant. The female deposits her eggs on the kelp, though much of it must doubtless be lost by the swift currents washing it off. These males and females remain in this place until the spawning season is over, generally by the 20th of July, after which they gradually disperse and quickly find their way back to the Pacific. Many times I have seen huge halibut lying like large flagstones beneath the lower stratum of fish, waiting for one to come within reach. Without moving a great distance I could see over a dozen halibut at a time. I estimated the weight of some of the larger ones to be not less than 350 pounds.

The natives of Atka repair to this place and have several turf houses of small size built there. It is also a garden spot where a few vegetables, such as radishes, turnips, and a few potatoes, are planted. To attend to their gardens and to be near the fishing grounds the Aleuts of many places have built these summer villages. Here assemble all the old men not able to hunt and the children and women of the hunters gone off on a summer's cruise for sea otters. These lay in a store of dried and salted fish for their sons and friends.

The natives obtain the greater number of the fish in the following manner: Each man has a two-holed bidarka (canoe). In it a small boy sits in the front hole while the old man sits in the rear hole. The man uses a pole of several feet in length (generally not less than 12 feet long), on which is firmly secured a hook of iron, having a flattened point with a sharp edge and a notch filed on the inner side to act as a barb. When the canoe arrives at the place the boy is ordered to seize hold of a strong frond of the giant kelp, which streams out sometimes for over a hundred feet, and among which the fish are most abundant. After coming thus to anchor the man carefully thrusts the pole into the water, and if the fish are plentiful he will soon feel them surging against it. He now begins to jerk it up and down in the water to gig any fish that may come along. In a few seconds he brings one out. The work now becomes exciting, for scarcely has the pole been again thrust in the water than it is jerked into another fish. A man may thus, in a couple of hours, take 200 to 300 fish. After the canoe is loaded it is taken to the shore, where the women slit open the back of the fish, take off the head, clean out the entrails, and with a cut on each side the backbone is removed to the tail. The two sides of the fish are left hanging together by the tail. This is to enable the fish to be hung over a pole to dry. Often the men bring the fish directly to the principal village and clean them there, though this is done more often when the fish are to be salted. At the season between June 25 and July 25 the fish are extremely fat from the abundance of a small crustacean, which has previously come in myriads to the same places as these fish. The fish which are to be dried are usually taken about the 1st of August, as they are so fat before that time that I have seen the oil drip from the drying fish. They also, from the presence of the oil, become rancid in a short time and are said not to keep so well.

At Attu Island also I had an excellent opportunity for studying the habits of these fish. At this place the fish are most abundant at the entrance to Chichagof Harbor, on the northeast shoulder of the island. Several islets and many reefs are disposed nearly across the entrance to the harbor. Between these the tide currents run with great velocity. An abundance of large kelp patches is found in the vicinity. The fish arrive at Attu, from the southwestward, about the 24th of April, though this date varies according to the openness of the season. It is rarely later than the 1st of May. The fish come at first in a straggling manner, and their first appearance is made known by their being caught on hooks while the men are fishing for other kinds. The first comers are usually nearly adult males. They are not fat on arrival, but soon become so from the abundance of small crustaceans that fairly swarm among the patches of seaweed by the 10th of May, and at which time the fish are tolerably numerous. By the 10th of June thousands of these fish can be seen in the shallow water (about 1½ to 8 fathoms deep) below. The natives here take considerable quantities of these fish and dry them for use at an early date. They rarely salt them for the reason that, they state, this fish makes the consumer thirsty. When they go to catch them they visit the various localities known to be the haunts of these fish, and by looking beneath the mass of kelp fronds can see them if present; if not, the fish are off in the open water. They then watch every floating piece of detached seaweed. It is constantly turning round and round, like in an eddy of water. The fish are playing with it, and there will be found an abundance. The gaff is quickly thrust into the water, and one is soon struck and brought out.

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[a] Contributions to the Natural History of Alaska, by L. M. Turner, p. 96, Washington, 1886.

I here had opportunity to come to the conclusion that these fish will bite readily at the hook. I saw them jump and struggle to get at the gaff and could feel them strike against it while it was in the water, and at times it was impossible to hold it in position, as the mass of moving fish carried it along with them.

Any kind of fresh fish may be used as bait on a small cod hook for these fish. A piece of scarlet flannel tied above the hook is good to attract the fish, as they will then bite voraciously.

With a hook a person can catch the fish as fast as put into the water. With the use of several hooks on one line, several fish may be taken at once. With the gaff the fish are taken in great quantities, equal to all demands. The run lasts at Attu until July 25, after which the fish are spent and slowly disappear from the waters.

These fish were not known at Attu previous to 1875. They came unexpectedly and were caught on hooks set for other fish. Since that time the people have had an abundance of them. From my own observations I am led to assert that 500 barrels of 200 pounds each can be procured at Attu in the season from June 1 to July 31. At the entrance to Chichagof Harbor is the only known locality at Attu where these fish resort. The natives assert that the coming of these fish was coincident with the disappearance of the sea lion (*Eumetopias stelleri*), and those natives maintain that the fish drove the sea lions off—just opposite to my own conclusions, for I think the fish come to those places where they will be least persecuted by the sea lions.

These fish are also reported to be abundant at Kiska Island, between the islands of Atka and Adak; also between Unalga and Unalaska, and also in the passes between some of the Shumagin Islands. I saw a few individuals in Captains Harbor, Unalaska Island, in the early part of July, 1881. This is the first instance of their occurrence in that locality. They were small in size and of the size which constitutes the upper stratum as spoken of in regard to the disposition of the fish on the spawning grounds of Amlia Pass.

This fish could be easily taken in great quantities, especially at Amlia Pass and Attu. Some writers of Alaskan affairs have mentioned exorbitant prices paid for a barrel of salted fish of this kind. They can be prepared at a cost of $2 per barrel for the fish at either Attu or Amlia. The cost of the barrel and salt, of course, is to be added. Only the necessary sheds for protecting the barrels from the weather would have to be erected. Native help could be procured at a cost of $1 per day for a man and 50 to 75 cents per day for the women, who can clean the fish as expertly as the men.

This species appeared at Atka about May 15, 1892, the large ones coming first. Natives stated that the fish are always found in the kelp and that they disappear late in September and early in October. They sometimes come into the harbor even in front of the village. Small ones, half the size of the largest, appear in July. Sea lions killed at various times throughout the winter frequently have their stomachs filled with Atka mackerel; hence it is believed these fish remain about the islands all the year. Captain Lennon found Atka mackerel in stomachs of fur seals taken in Bering Sea in July. They evidently spawn in June. Numerous females examined May 28 were found with nearly ripe roe, the eggs being about the size of no. 6 shot.

There is no other fish of the Aleutian Islands, whether in salt water or fresh, that is so interesting to the angler as the Atka mackerel. In the first place it is a most beautiful fish, with its alternating broad bands of glossy black and chrome yellow and its trim form; and its game qualities are of no mean order. It takes the hook readily and makes a good fight. The usual method of taking it is by "jigging." On May 28, 1892, the senior author had excellent sport catching these fish near the mouth of the bay at Attu. Three hooks tied together in a bunch were used, and just above them was tied a piece of white muslin. The line was weighted so that the hooks would descend quickly. When they had reached the bottom, or near it, they would be jerked up and down and the fish, striking at the muslin, would be hooked or would catch the hook in their mouths. The lines would be let down through the kelp in water 15 to 25 feet deep.

The fish were in schools and it was easy to get great numbers; in fact, one would be kept busy hauling in the fish and taking them off the hook. Usually they were near the bottom when the fishing began, but they soon became greatly excited and would come near the surface, where they could be seen swimming about as if greatly disturbed and evidently searching for the piece of white muslin which had attracted their attention. When first hooked they would come up very readily; in fact, they seemed to swim upward until near the surface when they would become alarmed and dart back and forth in their efforts to free themselves. Then the sport was very exciting.

The Atka mackerel reaches a length of 18 inches and a weight of 3 or 4 pounds. The average weight of 585 fish was about 2½ pounds and the maximum 3½ pounds.

Commercially this species has never come into the prominence which its excellence as a food fish justifies. As a fresh fish it is delicious either baked or fried. It takes salt well, and in that condition is a very palatable and nutritious article of food. There seems to be no good reason why an important fishery should not be established.

93. **Hexagrammos decagrammus** (Pallas). *Rock Trout.*

Four specimens 3 to 8 inches long, collected at Sucia Island, Gulf of Georgia, May 6, 1894. No. 2230–2233 and 2235, each about 14 inches long, collected by the *Albatross* in Redfish Bay, Baranof Island, September 6, 1897, showing the two distinct color patterns, and no. 1729 (1763), a specimen 13 inches long, collected at Sitka by Luttrell.

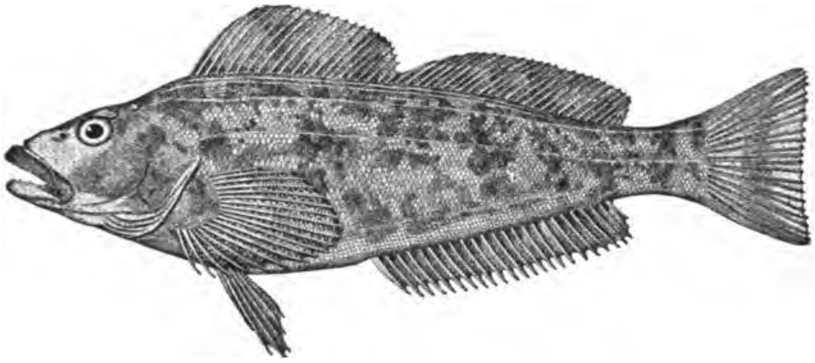


FIG. 41.—Hexagrammos decagrammus (Pallas).

Recorded by Bean (1882) from Sitka; Old Sitka; Chatham Strait; and Unalaska, and in 1884 from Tolstoi Bay. Nelson (1887), Unalaska.

This species, also called *boregat* and *bodieron* by the Russians, ranges from Point Conception to Kodiak Island. It is most abundant southward and is common at San Francisco. It attains a length of 18 inches and is a good food fish.

94. **Hexagrammos octogrammus** (Pallas). *Alaska Greenling.*

This species has been obtained by the *Albatros* at Uganuk Bay, Kodiak Island (1897), Attu Island, Sucia Island, and Akutan Bay (1894), Tareinski Harbor, and Unalaska, Litnik Bay (1900). Bean has recorded it (1882) as *H. ordinatus* from Old Sitka, from Popoff Island (Shumagin Group), and Iliuliuk and Chernofski; and Nelson (1887) records it from Unalaska. It has been recorded also from Petropaulski, from Robben Island, and Iturup Island. In 1903 the *Albatross* seined an example (no. 2971) 9.5 inches long at Uyak Bay, another (no. 2976) 10 inches long at Snug Harbor, and one 10.25 inches long at Union Bay. An example (no. 151) 4.25 inches long from Tareinski Harbor shows plainly the black humeral spot and 7 black transverse bars on anal fin; supraoccipital flap very small, about equal to pupil; a few white spots on side.

The center of abundance of this species seems to be among the Aleutian Islands, and its range extends westward to Petropaulski and Robben Island and south to Sitka. The species attains a length of a foot or more and is a good pan fish.

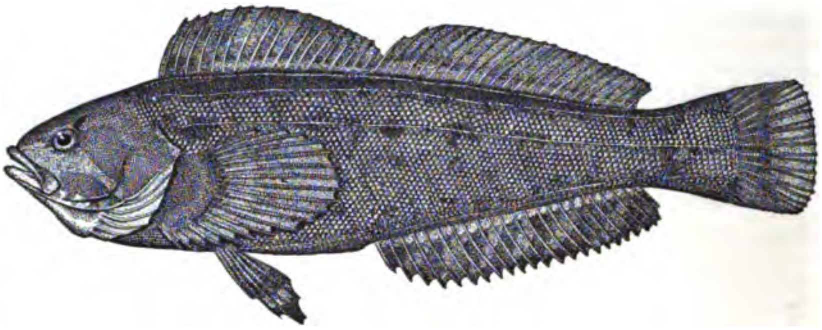


FIG. 42.—Hexagrammos octogrammus (Pallas).

95. **Hexagrammos stelleri** Tilesius. *Greenling.*

This species seems to be rather common all along the coast of Alaska, specimens having been taken with hook or seine at Marrowstone Point; Otter Bay, Sucia Island; Alert Bay, Union Bay, Kilisut Harbor, Metlakahtla, Cleveland Passage, Loring, Skagway, Sitka, Killisnoo, and Litnik Bay.

The specimens taken were chiefly small ones, the smallest being 3 inches long—one each from Litnik Bay and Ankau River, the largest 13.5 inches long from Litnik Bay; another specimen, 13.25 inches long, is from Marrowstone Point.

The specimen from Marrowstone Point had in life back and side olivaceous with paler greenish spots; side with about 8 darker vertical bars, these ill defined; head greenish olivaceous; belly and under parts yellowish, dusted with dusky greenish; dorsal olivaceous, with small yellowish spots more or less coalescing and large blackish areas near base; caudal orange red; anal with 6 oblique lemon bars, separating broader darker bars, edge of fin bluish reddish; pectoral reddish yellow, barred with darker; ventral pale yellowish with reddish tinge. The young are much blotched and mottled with bars on the side. These markings tend to disappear in the larger examples, leaving the color in alcohol uniform brownish. .

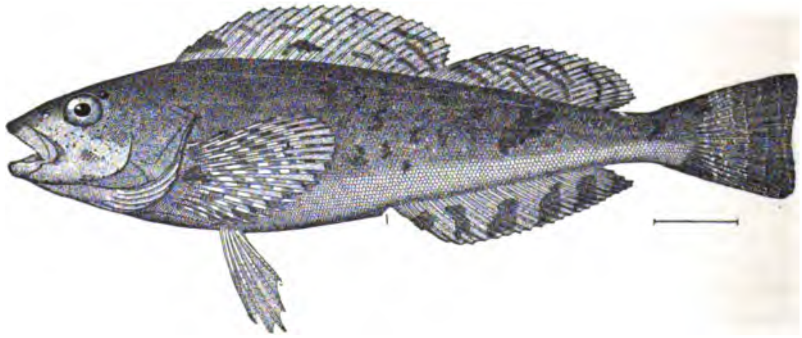


FIG. 43.—Hexagrammos stelleri Tilesius.

The species has also been recorded as *Hexagramus asper* (Nelson 1887) from St. Michael. Bean (1882) records it from Sitka; Port Mulgrave, Yakutat Bay; Refuge Cove, Cook Inlet; St. Paul, Kodiak; Unalaska, Atka, St. Michael, and Port Clarence. Gilbert (1895), stations 3228, 3229, 3231 to 3234, 3239 to 3241, 3243, and 3245 in Bristol Bay.

The species ranges from Kamchatka and Unalaska to San Francisco, being perhaps most abundant in Puget Sound. It reaches a length of a foot and is of value as a food fish.

96. **Hexagrammos superciliosus** (Pallas). *Red Rock Trout.*

Three specimens, 11 to 14.63 inches long, obtained by Mr. Rutter at Karluk, where another 18.5 inches long, was collected in 1893 by the *Albatross*. We have also examined Nelson's (1887) specimens from Kyska; Akutan Bay; Redfish Bay, and Unalaska; Bean's from Sitka; Port Mulgrave, Yakutat Bay; Amchitka; St. Paul, Kodiak Island; Chernofski, and Attu; and Gilbert's (1895) from Makushin and Chernofski Bays, Unalaska Island and stations 3244 and 3245 in Bristol Bay.

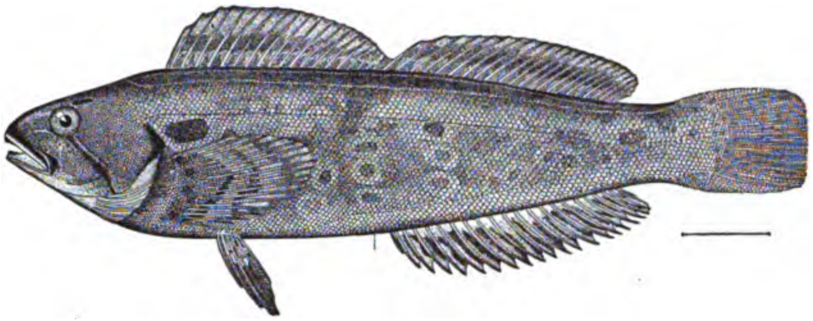


FIG. 44.—Hexagrammos superciliosus (Pallas).

We fail to find any differences in the supraocular flap of this species and that of *octogrammus*. Dr. Gilbert says it may be distinguished from *octogrammus* by the larger flap, smoother scales, and deeper notch in the dorsal. The deeper notch in the dorsal and the complete fourth lateral line in *superciliosus* are the only marked differences we can find in our specimens. The specimen from Redfish Bay is very highly colored with large white spots and bars, the spots being on base of pectoral and lower part of body, the bars running irregularly over body and head.

This species ranges from Bering Sea to Monterey Bay but is most abundant northward. It grows to a length of nearly 2 feet and is a palatable food fish.

97. **Hexagrammos lagocephalus** (Pallas). (Pl. xv, fig. 2.)

The home of this species is in the western parts of Bering Sea. It is known to occur about Bering, Robben, and Iturup islands. The only specimen known from Alaskan waters was obtained at Attu in 1894 by the *Albatross*. It is no. 1665, U. S. National Museum, and is 19 inches long.

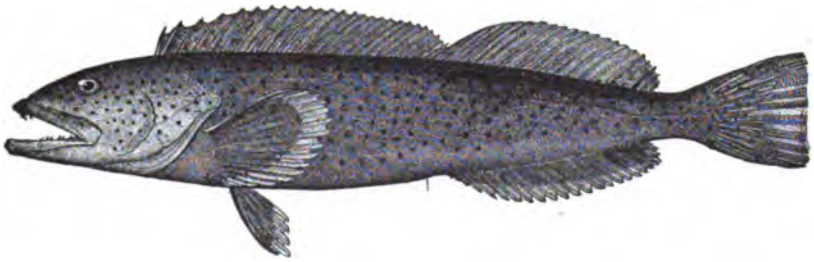


FIG. 45.—Ophiodon elongatus Girard.

98. **Ophiodon elongatus** Girard. *Cultus Cod.*

Recorded from Sitka by Bean in 1882.

Three small examples, 4 to 5 inches long, from Port Townsend; one (no. 02832), 12.5 inches long, from Marrowstone Point. The species was also seen at Quarantine Station, Union Bay; Port Alexander; Sitkoh Bay; and Loring. It was taken both in the seine and with hook and line. We also have a specimen 12 inches long taken by the *Albatross* at Port Etches, Prince William Sound, 1897.

The cultus cod occurs on our west coast from Santa Barbara northward to Prince William Sound, and is abundant throughout most of its range. It reaches a length of nearly 4 feet and a weight of 30 to 40 pounds. Although not a high-grade food fish, its size and abundance make it a species of considerable commercial importance. As a game fish also it is of interest, taking the hook freely and affording much sport to the angler.

99. **Zaniolepis latipinnis** Girard.

This monotypic species is abundant in rather deep water from San Francisco northward at least as far as Puget Sound. We have 31 specimens 5 to 7.5 inches long collected by J. P. Todd near Seattle, 1903. It reaches a length of a foot and is a slender fish of dry, firm substance and singular form, little valued as food.

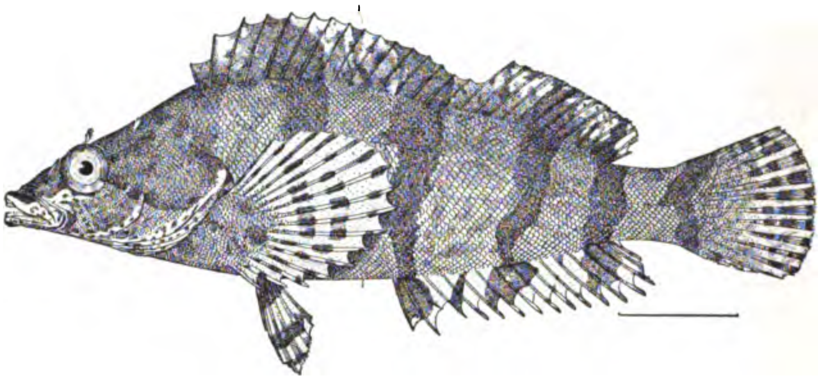


FIG. 46.—Oxylebius pictus Gill.

100. **Oxylebius pictus** Gill.

This species occurs on rocky shores from Monterey Bay northward at least to Puget Sound. It is a small fish, seldom exceeding 10 inches in length. It dwells in the kelp, where it is usually abundant, though it is rare in collections. It is not of much food value. We have one specimen 8 inches long, taken by the *Albatross* at Seattle, March, 1892.

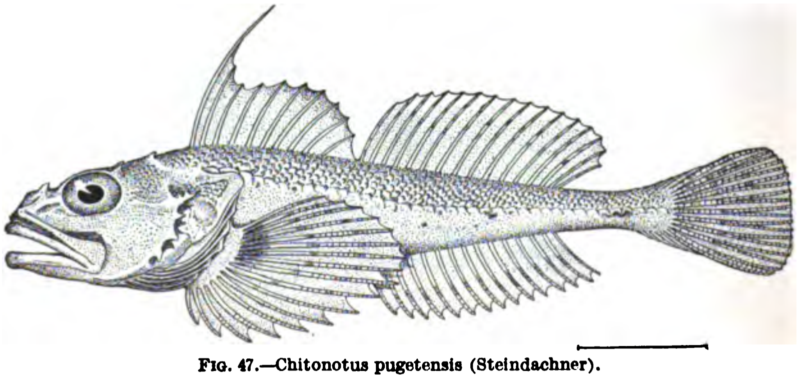


FIG. 47.—Chitonotus pugetensis (Steindachner).

Family 33. COTTIDÆ. The Sculpins.

101. **Chitonotus pugetensis** (Steindachner).

Fourteen specimens, 2.5 to 4.5 inches long, collected by J. P. Todd, near Seattle, in 1903.

A conspicuous nasal tentacle about as long as pupil. Anal dark in the males. The species reaches a length of 6 inches and occurs from San Francisco to Puget Sound in moderate depths.

102. **Tarandichthys filamentosus** (Gilbert).

One specimen 2.5 inches long dredged at station 4193, off St. Mary Mission. Not before recorded north of southern California.

Eye rather larger than given in current descriptions, being scarcely 3 in head; filaments on preopercle not evident.

103. **Tarandichthys tenuis** (Gilbert).

Two examples, 2 and 2.5 inches long, from station 4204, near Fort Rupert, and two, 2.1 and 3.75 inches long, from station 4193, in the Gulf of Georgia. Not previously recorded from north of San Francisco.

In our specimens the maxillary reaches anterior edge of pupil; gillrakers small and tubercular; peritoneum dusky; 2 parietal spines; first 2 or 3 scales of lateral line enlarged, the first with a distinct spine; pearly patches on base of pectoral.

The larger specimen from Gulf of Georgia had its stomach filled with shrimps and its abdominal cavity full of thread-like worms.

104. **Icelinus burchami** Evermann & Goldsborough, new species.

Head 2.8 in length; depth 4.6; eye 3.25 in head; snout 4.5 in head; maxillary 2.2; mandible 2; interorbital 2.25 in eye; dorsal IX-16; anal 14; pectoral 18; lateral line 38.

Body comparatively slender, tapering rapidly backward to caudal fin; head rather large; mouth moderate, low, terminal, nearly horizontal, the lower jaw slightly included; maxillary rather short, reaching posterior edge of eye; eye moderate, somewhat ovate; nasal spines short and obscure; nasal tentacle obsolete; supraorbital with a flat, black, bifid cirrus posteriorly, its length about equaling the pupil; a slender black occipital filament; a small white filament near tip of maxillary; occipital ridges not prominent, the included space flat, not pit-like; interorbital space flat, the median ridge very faint; preopercular spine rather strong, its length about 1.5 in orbit, three sharp spines on its upper edge directed upward, a short, sharp spine at the tip; under edge of peropercle with 3 short, stout, triangular spines, the first and second directed backward and slightly downward, the third, which is longest and sharpest, directed downward and forward; opercular spine flat and obscure; a double row of scales or plates along upper part of side, beginning under about the fifth dorsal spine and ceasing under the last dorsal ray but one, the row double throughout its entire length except posteriorly, where the lower row ceases three scales in advance of the upper row; upper edge of caudal peduncle, narrow space between the double row of scales, just described, and the dorsal fin, and broad space between it and the lateral line, naked; entire body below lateral line naked; no postpectoral plates. Fins well developed; spinous dorsal with the spines slightly filamentous, the longest about 2.75 in head; longest dorsal ray 3 in head; anal similar to soft dorsal; caudal somewhat rounded, its length 1.8 in head; pectoral broad, reaching past front of anal; ventrals very short and inconspicuous, their length scarcely exceeding diameter of pupil.

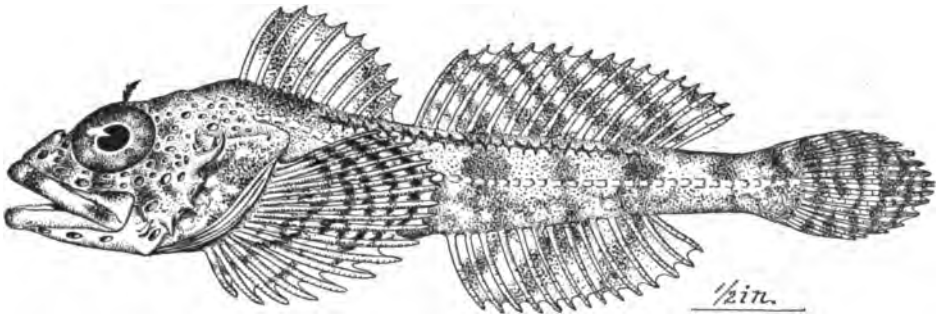


FIG. 48.—Icelinus burchami Evermann & Goldsborough, new species. Type.

Color in alcohol, yellowish brown; body and head blotched and mottled with small whitish spots and darkish irregular blotches; dorsal, anal, and caudal fins dark, blotched with white; pectoral similar, the lower rays whitish at tip, the interradial membranes darker.

This species is related to *I. borealis*, from which it differs chiefly in the larger eye, the shorter snout, the weaker nasal spines, the shorter preopercular spines, and the less complete series of scales along the base of the dorsal. Type, no. 57822 U. S. National Museum (field no. 99), a specimen 4 inches long from Albatross station 4228 in 41 to 134 fathoms, off Loring, Alaska, July 7, 1903. Cotypes: No. 5229, Bureau of Fisheries; no. 20010 Museum Stanford University; no. 57825, U. S. National Museum, and no. 6117, Field Museum, all from the same place; and no. 33003, Academy Natural Sciences, Philadelphia, from Behm Canal, near Loring, July 8, 1903.

This interesting species is named for Mr. James S. Burcham, a young naturalist of great promise, who lost his life at Lake McDonald, November 12, 1905, while in the employ of the Bureau of Fisheries.

105. **Icelinus borealis** Gilbert.

This species is common and widely distributed. We have examined specimens from the following localities: Albatross stations no. 4205, 4209, 4212, 4213, 4217, and 4218 (all in Admiralty Inlet), 4276 (Alitak Bay), 4285 (Chignik Bay), 2428 (Behm Canal), 3597 (off coast of Washington), Seattle, and Loring. It had been previously recorded by Gilbert (1895) from various Albatross stations north and south of the Aleutian Islands and in Bristol Bay. The known range is, therefore, from Bristol Bay and the Aleutian Islands to Puget Sound.

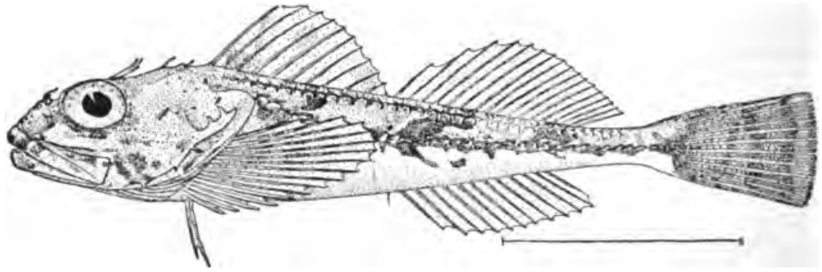


FIG. 49.—Icelinus borealis Gilbert.

Our specimens are 1.6 to 3.25 inches long. The length (2.5 feet) given in Fishes of North and Middle America is evidently an error. We are unable to distinguish *I. strabo* Starks from this species.

106. **Astrolytes fenestralis** (Jordan & Gilbert).

The collection contains one specimen 3 inches long, seined at Metlakahtla, 6 smaller specimens seined at Admiralty Head, Whidby Island, and 5 specimens from Sucia Island; also 13 specimens collected by Mr. Rutter on the beach at Karluk and 13 by Mr. Chamberlain at Loring. Recorded from Unalaska and Sanborn Harbor, Shumagin Islands by Bean (1882) as *Artedius notospilotus*, and from the Shumagin Islands by Jordan & Gilbert (1899).

Head 2.9 in length; depth 4.6; eye 4.3 in head; dorsal IX-17; anal XII; lateral line 36; maxillary extending to posterior border of pupil.

This species reaches a length of about 5 inches. Its known range extends from Puget Sound to Unalaska.

107. **Stelgidinotus latifrons** Gilbert & Thompson.

One specimen 1.13 inches long, from station 4213, near Admiralty Head.

Head 3.1 in body; depth 4.9; eye 3.5 in head; snout 4; maxillary 2.5; interorbital equal to eye; dorsal IX, 17; anal 14; ventral I, 3; pectoral 15; branchiostegals 6; pores 35.

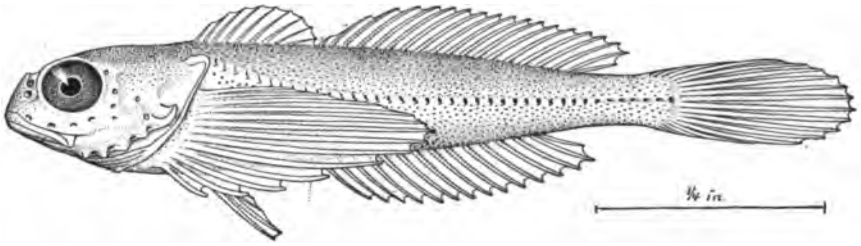
Body rather elongate, not much compressed, gradually tapering from head to the rather slender caudal peduncle, the least depth of which is about 3 in head.

Head rather small, lateral profile of snout somewhat blunt and rounded, upper profile somewhat rounded; interorbital rather broad and somewhat concave, nasal spines prominent, a round filament at the base of each, the sheath of the premaxillary pedicel rising between them as a stout, blunt spine; occiput rounded, without spines or cirri, a cirrus or two near tip of opercle; preopercular spines 4, the upper curved and hooked upward, rather blunt, but strong, and covered with skin, the others minute, all extending as mucronate points from a broad base, and all apparently pointing upward; a series of large pores under eye and along lower edge of preopercle and lower jaw; mouth small, somewhat oblique, the tip of premaxillary about on a line with lower margin of orbit; maxillary reaching to anterior margin of pupil, lower jaw included; teeth minute on jaws and vomer; gill-membranes forming a free fold across isthmus; origin of spinous dorsal above gill-cleft, its base 1.33 in head, its upper margin parallel with back; base of soft dorsal 2.9 in body, spinous and soft dorsal connected by membrane; pectoral 2.66 in body, quite large, pointed, reaching a considerable distance beyond origin of anal; ventral 1.66 in head, nearly reaching vent; length of caudal about equal to head; anal quite long, its base about equal to length of head; caudal apparently truncate, its origin nearly vertical from that of soft dorsal; vent considerably anterior to middle of body.

Head naked, the rest of the body covered with small papillæ; enlarged scales along lateral line, especially in front, pores somewhat conspicuous for the whole length; plates of lateral line not keeled, but each bearing several small spines on posterior margin; a series of indistinct transverse wrinkles behind axil.

Color mottled olivaceous on sides, the mottlings indistinct, so disposed as to form a series of about 5 saddle-like markings across the back about equally distributed, the light areas between them nearly circular; top of head dusky; fins plain.

Stelgidinotus latifrons **Gilbert & Thompson, Proc. U. S. Nat. Mus., vol. XXVIII, 1905, p. 977, near Bremerton, Wash.**



FIG, 50.—Stelgidonotus latifrons Gilbert & Thompson. Type.

108. **Artediellus pacificus** Gilbert.

Our collections contain specimens from the following localities: Albatross station 4285 (Chignik Bay), 4268 (Afognak Bay), 4276, 4277, 4278, and 4279 (all in Alitak Bay); and 3653 (Bering Sea). The species was originally described from station 3216, south of Sannak Island, and is recorded by Gilbert from many stations in Bristol Bay.

A female 2.5 inches long, from station 4279, August 6, contained 105 nearly ripe eggs, measuring about 18 to the inch. Of the 15 specimens from Alitak Bay, 2 are males which exhibit a markedly fuller development of the dorsal fins than the others. A small thread-worm was found in the abdominal cavity of one specimen.

109. **Rastrinus scutiger** (Bean).

Originally described by Bean (1891) as *Icelus scutiger* from Albatross station 2853, off Trinity Island. Recorded by Gilbert (1895), as *Icelus scutiger*, from station 3339 south of the Alaskan Peninsula. Not obtained by us.

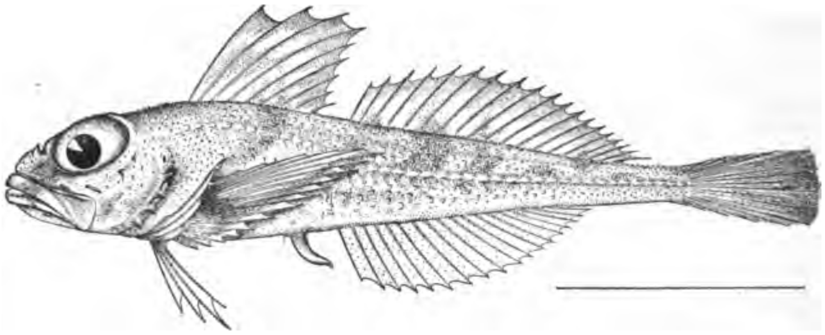


FIG. 51.—Rastrinus scutiger (Bean).

110. **Icelus bicornis** (Reinhardt).

Two specimens from station 4281, one from 4285, one from 4286 (all in Chignik Bay), and one from 4278 (Alitak Bay). These range from 1.75 to 3.2 inches long. Also recorded from many stations in Bristol Bay (Gilbert 1895).

This species is easily distinguished by the 2 pairs of spines on occiput, but the specimens we have vary as to the number of dorsal spines, there being 8 or 9, and the rays vary from 17 to 20.

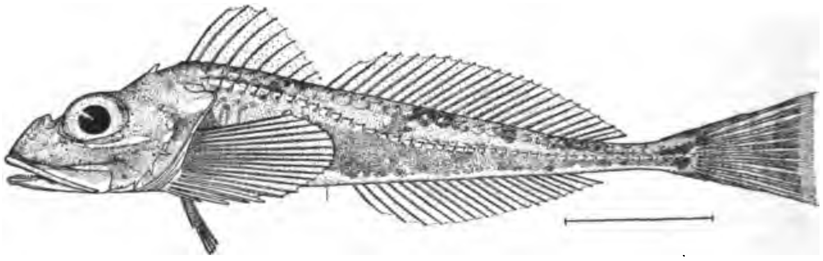


FIG. 52.—Icelus spiniger Gilbert.

111. **Icelus spiniger** Gilbert.

One specimen 3.25 inches long, dredged at station 4227 in Behm Canal, near Loring; 3 specimens 2.4 inches long from station 4281, in Chignik Bay; 2 specimens 2.6 inches long from station 4273 in Alitak Bay; 2 specimens 1.75 and 2.4 inches long from station 4283, in Chignik Bay; 1 specimen from 4289, 3 from 4291, 6 from 4292, 2 from 4293, and 6 from 4295, all in Shelikof Strait; these vary in length from 2 to 3.25 inches.

Originally described by Gilbert (1895) from stations 3216, 3223 to 3226, 3257, 3258, 3267, 3278 to 3280, 3292, 3302, 3311, 3334 and 3336, in the vicinity of Unalaska Island and in Bristol Bay.

112. **Icelus euryops** Bean.

Originally recorded by Bean (1891) from station 2853, off Trinity Islands, where 3 specimens were secured. Not taken since that time.

113. **Icelus vicinalis** Gilbert.

Originally described by Gilbert (1895) from stations 3324, 3330 to 3332 in Bristol Bay (1890). Not taken since.

114. **Icelus canaliculatus** Gilbert.

Originally described by Gilbert (1895) from station 3329 north of Unalaska (1890). No other specimens have been taken.

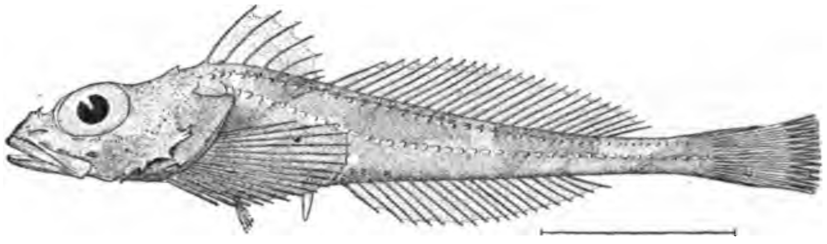


FIG. 53.—Icelus canaliculatus Gilbert.

115. **Radulinus asprellus** Gilbert.

Twenty-one specimens, varying from 0.75 to 5 inches, are in the collection, representing the following localities: Station 4221, mouth of Hood Canal; station 4219, Admiralty Inlet; station 4204, off Fort Rupert, British Columbia; station 4191, in outer harbor at Nanaimo, British Columbia; Kasaan Bay; station 4226, Behm Canal, near Loring; station 4234, in Yes Bay; and near Seattle by J. P. Todd.

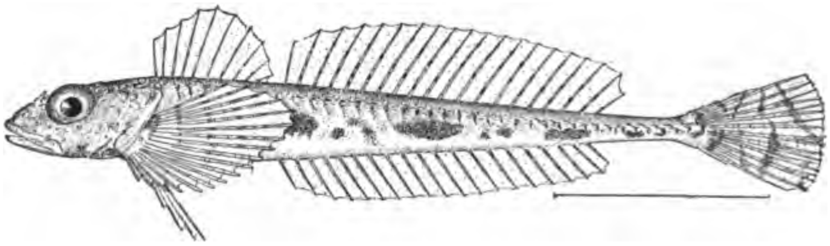


FIG. 54.—Radulinus asprellus Gilbert.

In the specimen from station 4226 the snout equals eye, and is 3.1 in head; maxillary 2.66; mandible 2.1; peritoneum silvery; length of caudal fin 1.45 in head. These measurements are not given in current descriptions.

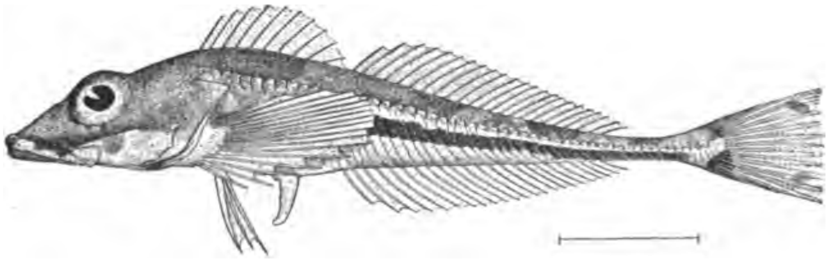


FIG. 55.—Triglops beani Gilbert.

116. **Triglops beani** Gilbert.

The collection contains specimens from the following localities: Albatross stations 4205, 4211, 4212, and 4213 (all in Admiralty Inlet), 4248 (Eastern Passage), 4268 and 4269 (Afognak Bay), 4242 (Karta

Bay), 4243 (Kasaan Bay), and from Behm Canal near Loring. The species had been previously recorded from Wrangell Straits (Bean 1884, as *T. pingelli*), Bristol Bay, at numerous Albatross stations (Gilbert 1895), and Bering Sea at Albatross stations 3598 and 3599 (Gilbert 1895).

The specimens obtained during the recent investigations were from depths varying from 14 to 71 fathoms. The males have a dark stripe on side just above anal fin, extending posteriorly from about first third of fin and uniting with the other median stripe at about fifth or sixth ray from last. Anal papilla in male well developed; peritoneum white, liver large, several large pyloric cæca, females not smaller than males.

This sculpin reaches a length of 4 to 8 inches and is of wide distribution, its known range extending from Puget Sound to Bering Sea and to Robben Island.

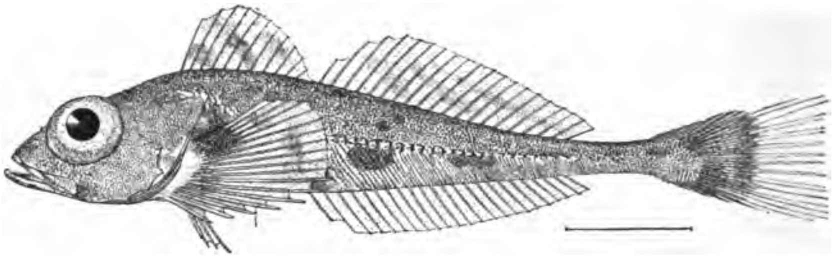


FIG. 56.—Triglops scepticus Gilbert.

117. **Triglops scepticus** Gilbert.

A single female example 5.75 inches long dredged at station 4291, in 65 to 48 fathoms, in Shelikof Strait. The interorbital space is more narrow than stated in current descriptions, being contained 3.5 instead of 1.5 times in the eye. About 7 of the lower rays of the pectoral are enlarged and exserted.

Originally described by Gilbert (1895) from stations 3215, 3222 to 3225, 3309, and 3339, south of Sannak and north of Unalaska Island.

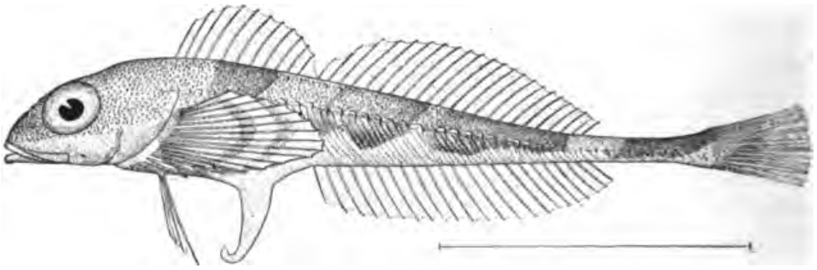


FIG. 57.—Sternias xenostethus (Gilbert).

118. **Sternias xenostethus** (Gilbert).

We have two specimens, 2.5 and 4.25 inches long, of this rare species, secured by the *Albatross* at station 3599, in Bering Sea. Only the type, a specimen 1.5 inches long, has heretofore been known. This was described by Gilbert (1895) from Albatross station 3220, north of Unalaska Island.

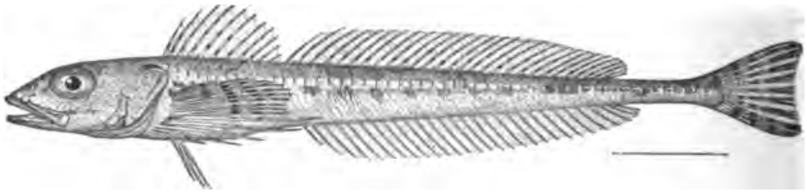


FIG. 58.—Prionistius macellus Bean.

119. **Prionistius macellus** Bean.

Recorded from stations 3214, 3218, and 3223, south of Sannak and north of Unimak Island (Gilbert 1895).

120. **Elanura forficata** Gilbert.

Originally described by Gilbert (1895) from stations 3213, 3214, and 3222, south of Sannak and north of Unimak Island.

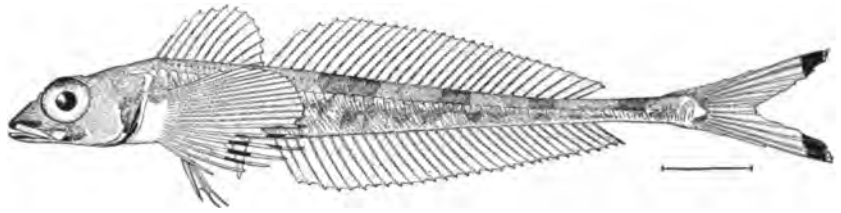


FIG. 59.—Elanura forficata Gilbert.

121. **Melletes papilio** Bean.

Originally described by Bean (1880) from St. Paul Island, Pribilof Group. It has not since been taken.

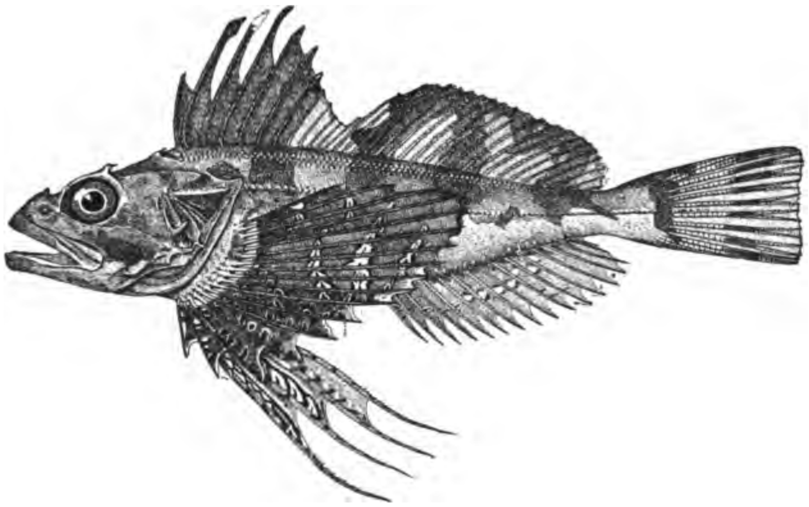


FIG. 60.—Melletes papilio Bean.

122. **Hemilepidotus jordani** Bean. *Irish Lord.*

Very abundant practically everywhere along the Alaskan coast. The collection contains specimens from the following localities: Shumagin Islands; stations 4268 and 4270, in Afognak Bay; stations 4283 and 4285, in Chignik Bay; station 4291, in Shelikof Strait. We also have 5 specimens 2 to 17 inches long, collected by the *Albatross* in other years at Sitka, Chignik Bay, and station 3600. The center of abundance for this species seems to be about Kodiak Island and the Alaska Peninsula.

The species was originally described by Bean (1882) from Unalaska, also recorded by him from Port Althorp; Port Chatham, Cook Inlet; St. Paul, Kodiak; Humboldt Harbor, Shumagins; Iliuliuk and Chernofski, Unalaska. By Gilbert from numerous Albatross stations about Amak and Unalaska islands.

The eye varies considerably in size, even in large examples, being usually 4 or even more in head; maxillary 2.3; mandible 2.2; snout 3.6; interorbital 1.3; peritoneum silvery. A specimen 17.5 inches long and weighing 2 pounds, taken over the rail with hook and line at Fox Bay, August 11, had in life the following colors: Side dirty olivaceous, with about 5 broad, irregular, darker blackish bars; belly white, with numerous small, roundish dark spots, few or none on middle line of belly and breast; top of head blackish, side of head somewhat blacker, the opercle and lower part of cheek nearly black;

edges of premaxillary, maxillary, and cheek, side of lower jaw, and first 2 or 3 branchiostegals and membranes rich lemon-yellow, remaining branchiostegals and lower side of head clean white; dorsal dark olive, the anterior portions black; pectoral dirty white at base, dirty olivaceous elsewhere; anal dark; caudal grayish olive, the membranes pale greenish or yellowish; tip of fin light greenish-yellow; eye reddish brown.

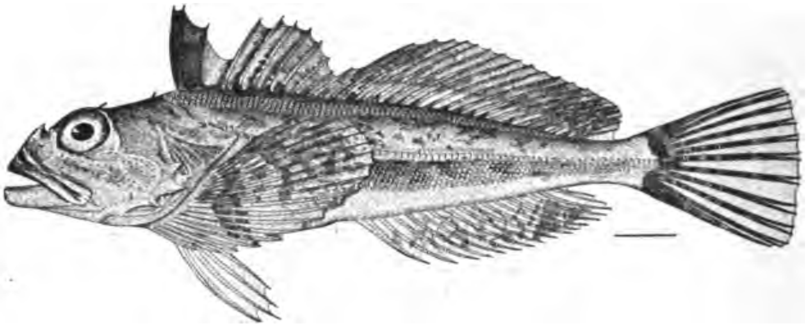


FIG. 61.—Hemilepidotus jordani Bean.

A female 13.25 inches long (no. 2985), taken in Chignik Bay, August 10, was full of small eggs.

We have another specimen, 4.75 inches long, from station 3599, in Bering Sea, taken in 1894. In this specimen the ventral fins are much longer than in typical examples, and have many tubercles on the under side. Five examples taken at Sand Point, Shumagin Islands, August 12, gave the following lengths and weights:

Length.	Weight.	
Inches.	*Lbs.*	*oz.*
18¼	1	15
15¾	1	13½
17½	2	2
15½	1	14
14⅛	1	6½

This interesting fish reaches a length of more than 2 feet, and is abundant about the Aleutian Islands.

It is very frequently taken in the salmon traps and is regarded as a nuisance by the fishermen. It is of some value as a food fish, but is rarely eaten. It is apparently not known in Southeast Alaska.

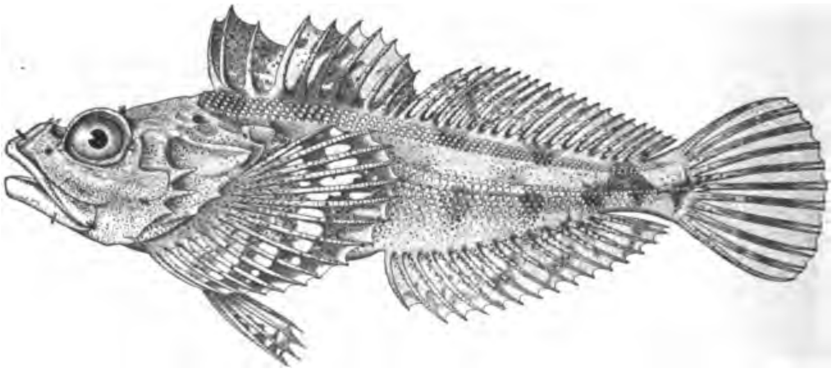


FIG. 62.—Hemilepidotus hemilepidotus Tilesius.

123. Hemilepidotus hemilepidotus Tilesius. *Red Sculpin.*

Very common, particularly about Kodiak Island and the Alaska Peninsula. The collection contains 9 specimens, 2 to 14.5 inches long, secured at Sucia Island; Hunters Bay; Loring; Killisnoo; Litnik Bay; Karluk; and in Uyak Bay. It has also been recorded (Bean 1882) as *Hemilepidotus trachurus* from Sitka; Port Althorp; Port Etches; Port Chatham; Cook Inlet; Popoff Strait and Coal Harbor, Shumagins; Unalaska; Kyska; Nazan Bay, Atka; Bay of Islands, Adak; Amchitka; Chichagof Harbor and Attu. Bean (1884), Fort Tongass and Nakat. Nelson (1887), Unalaska.

Known from Kamchatka to San Francisco. Not common in Bering Sea, but appears to be abundant from Sitka to Puget Sound. It reaches a length of 18 inches and should be of some value as a food fish.

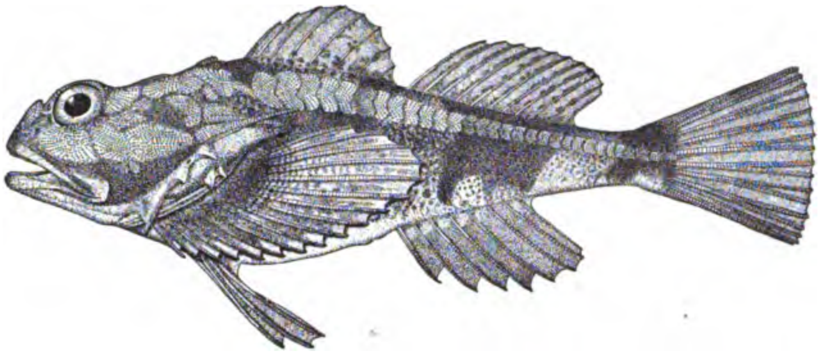


FIG. 63.—Enophrys bison (Girard).

124. **Enophrys bison** (Girard).

This sculpin is quite common south of Killisnoo. No specimens were secured by us north of this point. The collection contains 34 specimens, 1 to 9.5 inches long, taken at the following places: Port Townsend; Marrowstone Point; Admiralty Head; Fort Rupert; Kilisut Harbor; Port Alexander; Port Ludlow; Sucia Island; Loring; Yes Bay; Cleveland Passage, and Killisnoo.

The species was recorded by Bean (1882) from Sitka, and from St. Paul, Kodiak Island.

125. **Enophrys claviger** (Cuvier and Valenciennes). (Pl. XVII, fig. 1.)

Recorded by Gilbert (1895) from station 3233, Bristol Bay. No specimens obtained by us.

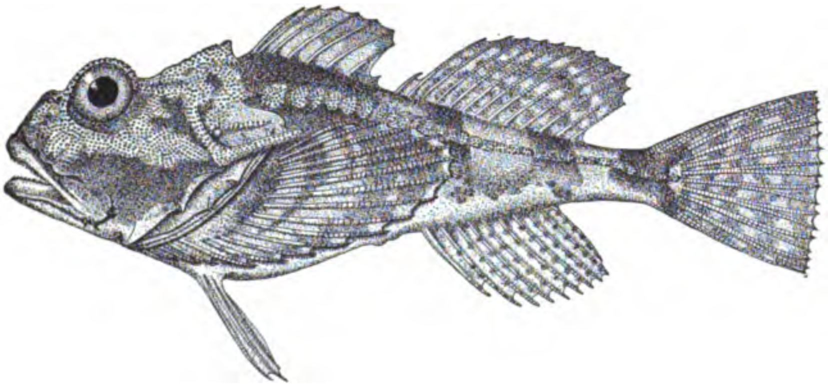


FIG. 64.—Ceratocottus diceraus (Pallas).

126. **Ceratocottus diceraus** (Pallas).

Recorded by Bean from Sitka (1882) and Tolstoi Bay and Fort Tongass (1884); by Gilbert from Herendeen Bay (1895), and by Jordan and Gilbert from St. Paul Island (1899, as *C. lucasi*).

We have 3 specimens, 5.75 to 6.25 inches long, collected at Tareinski, Kamchatka, June 21, and 2 specimens each about 3 inches long and each taken from the stomach of a halibut, one at Killisnoo, July 26, the other somewhere in Southeast Alaska, locality not definitely recorded. These specimens indicate that *Ceratocottus lucasi* Jordan and Gilbert is the young of *C. diceraus*.

127. **Cottus asper** Richardson. *Prickly Bullhead.*

Two specimens, 4 and 4.5 inches long, seined in upper stream of Deep Bay at Loring; 1 specimen, 4.3 inches long, at Loring; 3 specimens, 5.5 to 6.5 inches long, taken on hook and line in Naha River at Loring; 1 specimen, 5.5 inches long, seined in Hunter Bay; 2 specimens, each about 3.25 inches long, taken on hook and line near the Fortmann hatchery; 2 specimens (no. 3031 and 3032), 6.25 and 7 inches long, from Hunter Bay, taken on hook and line.

Thirty-five specimens, 1.75 to 7.5 inches long, collected in McDonald Lake, September 26, 1905. These are variously rough and smooth on the sides. The size does not seem to make any difference in the roughness, it being present or absent in all sizes. The black spot on the posterior part of dorsal disappears in the larger examples.

Seventeen specimens, 3 to 6 inches long, seined in McDonald Lake, August 24, 1905; agree with the preceding in regard to roughness.

Six specimens, 4 to 6.75 inches long, collected in fyke net in McDonald Lake, July 29, 1905. These specimens are smooth, except for a small area under pectoral, which is slightly rough.

Twelve specimens, 3.5 to 5 inches long, seined in McDonald Lake on August 22, 1905. The stomach contents were chiefly snails and parasitic worms. These specimens vary greatly in roughness of body, some having only a slight rough place under pectoral, others of the same size and of different sizes having the entire side of body more or less rough; all have a very distinct black blotch as large or larger than eye on posterior base of spinous dorsal; the fins are otherwise unmarked.

In addition to the above there were secured from Yes Bay and McDonald Lake 26 specimens varying from 2 to 5 inches, and 18 specimens from 2 to 6.5 inches from Loring and vicinity; two of the latter taken in Steelhead Creek, June 19, 1904, were full of nearly ripe eggs.

This species is common in fresh-water streams and lakes about Loring, and at the Fortmann hatchery might be seen any day in the clear waters of the stream or lake. It is reputed to be very destructive to salmon eggs.

Following the suggestion of Mr. J. O. Snyder (in "Notes on the Fishes of the Streams flowing into San Francisco Bay, California," Appendix to the Report of the Commissioner of Fisheries to the Secretary of Commerce and Labor for the year ending June 30, 1904) that *C. asper*, dorsal rays 19 to 22, anal 16 to 18, may be separated from *C. gulosus* dorsal rays 17 or 18, anal 12 to 14, by the greater number of dorsal and anal rays in the former, and also that *C. asper* is confined largely to the lower courses of streams, while *C. gulosus* is found farther up where the water is clear and the current rapid, we identify our specimens as *C. asper*. They were all taken in or near tide water, and the following table of fin counts places them with *C. asper:*

Locality.	No.	Dorsal.	Anal.	Palatine teeth.	Length.
					Inches.
Loring	1	VIII, 21	17	Present	6.5
Do	2	IX, 20	17	do	5.5
Do	3	VIII, 21	17	do	6.0
Do	4	IX, 20	17	do	4.25
Naha River	5	X, 21	17	do	3.0
Do	6	X, 21	17	do	3.5

Locality.	No.	Dorsal.	Anal.	Palatine teeth.	Anal length.	Vent.
Hunter Bay	7	VIII 21	16	Present	3.0	Posterior.
Do	3032	IX, 22	15½	do	3.2	Do.
Do	3031	IX (+), 22	17½	do	3.1	Do.
Loring, Deep Bay	8	VIII, 20½	17	do	3.0	Do.
Do	9	VIII, 21	16½	do	2.9	Nearly median.

Length of anal base usually about equal to head, sometimes, as in last example, somewhat longer.

128. **Cottus gulosus** (Girard).

Specimens of this species were secured only at Loring and Boca de Quadra. They were 16 in number and measured 1 to 4 inches in length. Many of the larger ones taken at Loring, May 29, 1904, were full of nearly ripe eggs.

This species is doubtless common throughout Alaska, but being found further up the streams away from brackish water and in places not usually visited by collectors, it has not been taken abundantly or recorded from many places.

129. **Cottus cognatus** Richardson. *Great Bear Lake Bullhead.*

One of the most interesting results of the side trip made to the headwaters of the Yukon was the securing of a fine series of specimens of *Cottus cognatus*. Until now the type of this species had remained unique, no additional specimens having come into any museum or having been collected by any naturalist so far as we are informed.

At Lake Bennett, July 19–21, 1903, 45 specimens were collected. They were obtained by the use of the seine at various places along the shore, chiefly toward the head of the lake above the railroad station and near the crossing of the Yukon and White Pass Railroad. These specimens range in length from 1.2 to 3¼ inches. Although the original description is very brief there is no doubt in our mind as to the identification. Following is a detailed description:

Head 3.66 to 4.1 in length; depth 5.13 to 6.2; eye 3.8 to 4.66 in head; snout 3.6 to 4; maxillary 2.25 to 2.5; mandible about 2; interorbital width 5.25 to 6; dorsal usually VIII–17 (VIII–15, VIII–16, IX–15, IX–17, and IX–18 indicate the range of variation); longest dorsal spine about 3 in head; longest dorsal ray 1.75 to 2; anal usually 11 or 12, varying from 10 to 13; longest anal ray about 1.75; pectoral 13 or 14, its longest rays (14 or 15) 3.87 to 4.2 in head, lowermost 7 or 8 rays thick, but not branched; ventral I, 3, the length 5.5 to 6 in head; caudal lobes about 5.

Body rather heavy forward, tapering gradually to the rather slender caudal peduncle; head moderate, evenly rounded above, interorbital space narrow, slightly concave; mouth moderate, somewhat oblique, maxillary reaching middle of pupil, lower jaw slightly included; branchiostegal rays 6; gill-membranes separate, joined to the isthmus; villiform teeth on jaws and a small patch on the vomer; caudal peduncle slender, its least width about 2 in its least depth; head entirely smooth; preopercle with a single spine at the angle projecting backward and upward, chiefly concealed by skin; lower edge of preopercle with one rather distinct broad spine projecting downward and forward, in front of which is another poorly defined spine or blunt point; opercle without spine; no other spines or filaments about head; body entirely smooth except a patch of small roughish scales under the pectoral; fins well developed, spinous and soft dorsal barely connected; caudal truncate or slightly rounded; pectoral broad at base, the tip reaching past beginning of anal; ventrals scarcely reaching vent; vent usually somewhat nearer tip of snout than base of caudal; there is, however, some slight variation in this character; in one specimen, apparently a female, it is equally distant from tip of snout and base of caudal.

A specimen 3⅛ inches long was, in life, dark olive, much mottled; trace of about 6 dark saddles less distinct than in most specimens; first dorsal blackish olive with a narrow orange edge, the fin mesially darker; second dorsal dusky olive and translucent, the olive in irregular blotches; caudal with 4 or 5 vague bars of darker olive; ventrals and anal uncolored; pectoral brown with 4 narrow irregular dark bars, the coloration more olive and more uniform than usual; a patch of light colored, rather coarse prickles behind axil; belly silvery; lower jaw greenish, faintly barred with 5 black dots.

There are two patterns of coloration, probably representing the two sexes, a darker and a lighter phase. The darker phase may be described as follows: Sides and top of head, anterior portion of body, the beginning of soft dorsal, and sides of body along base of soft dorsal and upper part of caudal peduncle, dark or blackish, more or less vermiculated with lighter; base of caudal fin with a large Y-shaped black area; tip of lower jaw dark; under side of head and entire lower parts of body yellowish white, profusely covered with numerous minute black or brownish punctulations; spinous dorsal black, white at the tip; soft dorsal vermiculated with dark and light, the distal half lighter; anal yellowish-white with fine dark punctulations; caudal dirty white, with fine dark punctulations and evidence of faint darker cross-bars; pectoral dark on basal two-thirds, lighter at the tip, with rather distinct vertical cross-bars of dark and light; ventrals yellowish-white, somewhat punctate with dark.

A specimen of the lighter phase may be described as follows: Head and upper parts of body brownish white, blotched with darker; occipital region dark; back with about 6 dark or brownish saddles, distributed as follows: The first, which is very small, at beginning of spinous dorsal, the second under last dorsal spines, the third under third to sixth dorsal rays, the fourth under eighth to tenth dorsal rays, the fifth under the last dorsal rays but one, and the sixth on base of caudal fin; the third and fifth plainest and extending below the lateral line; entire under parts yellowish-white with very fine dark punctulations; fins essentially as in the darker form.

Cottus cognatus Richardson, Fauna Bor.-Amer., iii, 40, 1836, **Great Bear Lake.** Günther, Cat., ii, 157, 1860. Jordan & Evermann, Fishes North and Mid. Amer., pt. ii, 1954, 1898.

130. **Cottus aleuticus** Gilbert.

Ninety-nine specimens 3 to 4 inches long collected by Mr. Rutter in Lake Karluk during the summer of 1903.

Head 3.75 to 3.85 in length; eye 5 in head; dorsal ix, 19; anal 12 or 13; pectoral 15.

The collection contains also 3 specimens 4 to 4.5 inches long from a small stream at the head of the flume at the Loring cannery, July 26; 4 specimens 2.75 to 3.25 inches long from the stream at the Fortmann hatchery, July 7, taken on hook and line; and 2 specimens 2.75 to 3.75 inches long from Steelhead Creek near Loring, May 8.

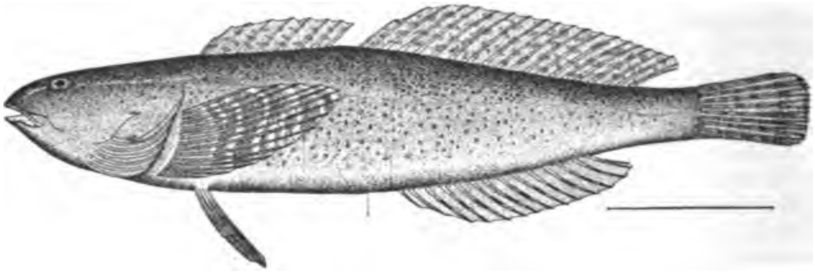


FIG. 65.—Cottus aleuticus Gilbert.

The Karluk specimens show quite a different color pattern from those taken at Loring, the body being much darker and plainer, with very little vermiculation or marbling; the fins sometimes marbled with dark; the spinous dorsal sometimes plain with very small dark punctulations, or the upper half of fin black, edged with white, these punctulations sometimes found on soft dorsal and anal. Many of these specimens have tubercles on ventral and pectoral fins, those on the ventrals sometimes arranged in patches.

The lateral line is not always complete, does not drop abruptly at end of soft dorsal, but ends there in some specimens, generally those with plain soft dorsal.

This species has been recorded by Bean (1882) as *Uranidia microstoma*, from Indian River, Sitka; St. Paul, Kodiak Island; Aleutian Islands; Iliuliuk, Unalaska. Gilbert (1895) from Iliuliuk, Unalaska. Rutter (1899), Karluk River and Lake and in Alitak Lake. Nelson (1887), mouth of Tanana River.

131. **Cottus chamberlaini** Evermann & Goldsborough, new species.

Head 3 in body; depth 4.3; eye 3.75 in head; snout 3.9; maxillary 2.5; interorbital space 5 in eye; dorsal ix-16, longest spine 3.3 in head, the longest ray 2.3; anal 11, longest ray 2 in head; pectoral 14, the length equal to that of head; ventral i, 4, the length 1.6 in head; branchiostegals 6.

Body fusiform, tapering rather rapidly from the heavy head to the long slender caudal peduncle, the body usually considerably constricted at the vertical connecting origins of anal and soft dorsal; head rather large; snout short; mouth moderate, low, nearly horizontal, the maxillary scarcely reaching front of pupil; a small patch of teeth on vomer, palatines naked; eyes large, high up and close together; interorbital space very narrow; anterior nostril in a very distinct tube; posterior nostril in an evident tube, which is shorter than that of the anterior; head entirely smooth, without cirri or spines except those on opercular bones; preopercle with one simple sharp spine at the angle, projecting backward and curved upward somewhat; edge of preopercle below this smooth or merely crenulate; opercle ending in a soft flap, subopercle with a rather distinct blunt spine projecting downward; body entirely smooth, except a small patch of asperities under the pectoral; lateral line complete or nearly so. Fins moderate; interval between spinous and soft dorsal short, but distinct; origin of spinous dorsal posterior to base of pectoral a distance equal to one-third diameter of eye; origin of anal slightly posterior to that of soft dorsal: caudal slightly rounded; pectoral long, reaching origin of anal; ventrals short, not reaching vent.

Color in alcohol: Upper parts dark, mottled with darker irregular blotches and lighter areas; about 4 distinct dark vertical blotches, one under spinous dorsal, 2 under soft dorsal and 1 on caudal peduncle; under parts yellowish-white, profusely covered with minute brown punctulations; spinous dorsal dusky, each ray with 1 or 2 black spots, the eighth spine almost entirely black, edge of fin creamy white; soft dorsal dusky, with numerous irregular black blotches, the edge somewhat creamy; anal pale, punctate with dark; caudal yellowish-white, crossed by 4 or 5 irregular, dark, vertical bars; pectoral similar to soft dorsal; ventrals white. The numerous specimens examined show but little variation, as may be seen from an examination of the following table:

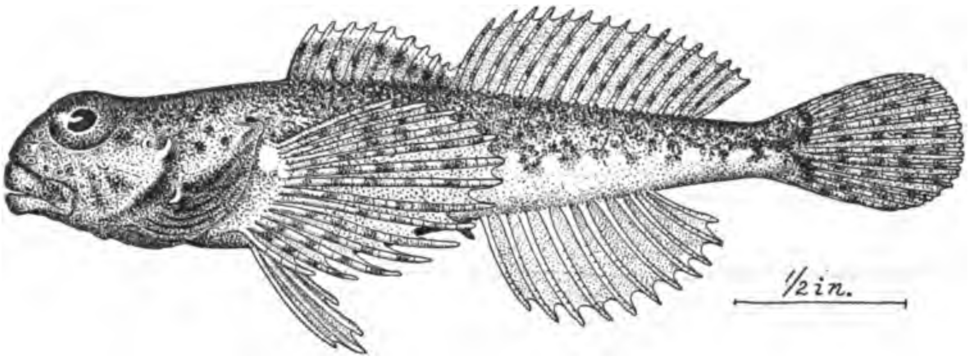


FIG. 66.—Cottus chamberlaini Evermann & Goldsborough, new species. Type.

VARIATION IN THE TYPE AND COTYPES OF COTTUS CHAMBERLAINI.

Tag No.[a]	Length in inches.	Head.	Depth.	Eye.	Snout.	Maxillary.	Interorbital in eye.	Dorsal fin.			Anal formula.
								Formula.	Longest spine in head.	Longest ray in head.	
119	2.9	3.2	4.3	3.75	3.9	2.5	5.0	IX, 16	3.3	2.3	11
120	2.9	3.0	5.1	3.5	3.8	2.5	4.8	VIII, 16	3.3	2.3	12
121	2.2	3.1	4.6	3.1	4.8	2.9	4.5	IX, 17	....	....	12
122	2.37	3.1	4.5	3.5	4.0	2.5	5.0	VIII, 16	....	....	12
123	2.63	3.2	4.5	3.2	4.0	2.0	4.5	VIII, 16	....	....	11
124	2.25	3.2	4.75	3.25	4.25	2.6	4.5	VIII, 16	....	....	12
125	2.0	3.1	4.5	3.2	3.1	2.3	4.5	VIII, 16	....	....	11
126	2.25	3.0	4.8	3.5	4.0	2.5	4.4	VIII, 16	....	....	11
127	1.75	3.5	5.0	3.5	5.0	3.0	5.0	VIII, 16	....	....	11
128	2.75	3.2	5.0	3.0	4.75	2.3	5.0	VIII, 16	....	....	11

[a] No. 119, type; nos. 120-128, cotypes.

This species seems to be related to *Cottus beldingi* and to *Cottus spilotus*. From the former it may be distinguished by the much larger eye, the narrower interorbital, the blunter head, the fewer anal rays, and the coloration; from *Cottus spilotus* it would seem to differ in the shorter anal, the more complete lateral line, in coloration and in other respects.

The collection contains 217 specimens, which we refer to this species. They vary in length from less than 1 inch to 2.9 inches. The collector's label, which should have accompanied these specimens, has been lost, but it is certain that they came from fresh water at Loring, Alaska, and that they were collected by Mr. F. M. Chamberlain in 1903.

Type no. 57823, U. S. National Museum, a specimen (no. 119) 2.9 inches long, probably from Loring, Alaska; cotypes, several specimens no. 61052, U. S. National Museum; no. 5230, Bureau of Fisheries; no. 20011, Stanford Univ. Mus.

We take pleasure in naming this species for our friend and associate, Mr. Fred. M. Chamberlain, naturalist of the steamer *Albatross*, who collected the type.

132. **Myoxocephalus polyacanthocephalus** (Pallas). *Great Sculpin.*

The collection contains 25 specimens, from 1.75 to 13 inches long; collected in 1903, at the following places: Marrowstone Point; Cleveland Passage; stations 4270 and 4272, Litnik Bay; Karluk; Admiralty Head; Metlakatla; Funter Bay; Point Ellis; Port Alexander; Snug Harbor, and Yakutat. The species was seen also at Dundas, Pablof, Sitkoh, and Uyak bays.

These specimens show that there is considerable variation in the relative distances between the supraocular spines themselves and the occipital spines. The distance seems to be relatively greater in the young examples than in the older ones.

In the larger specimens the general color is much darker than in the smaller ones, the light colors, especially posteriorly, fading into darker; belly and ventral fins distinctly mottled and spotted. In all the smaller examples the belly is pale and there are 3 very distinct dark bars across the body; the first under the sixth to eighth dorsal spines, extending slightly forward and downward across base of pectoral; the second under soft dorsal, beginning under the third ray, and extending under nearly full length of fin and downward nearly to anal, this bar more or less broken at its center and sometimes divided, forming 2 bars, which may be called second and third, 1 over anterior, the other over posterior part of soft dorsal; the last bar (fourth when the second is divided, otherwise third) covering posterior part of caudal peduncle.

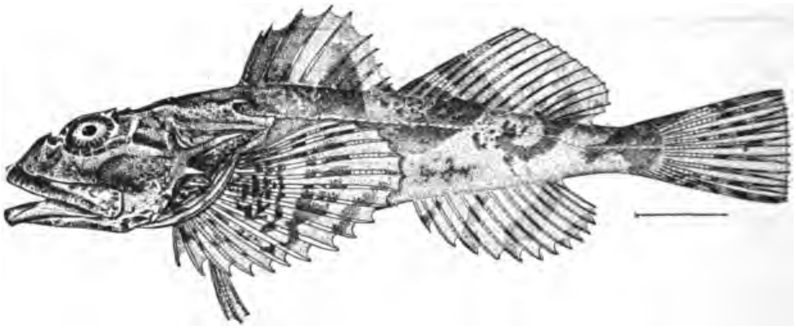


FIG. 67.—Myoxocephalus polyacanthocephalus (Pallas).

Mr. Rutter secured at Karluk, June 8–10, 1903, 18 very small specimens one-half to 1 inch long and 3 specimens 3.75 to 6 inches long. The 6-inch specimen had in its stomach 4 *Blennicottus acuticeps*, each 1.75 inches long and 1 *Pholis ornatus* 4 inches long. They were very little digested, the *Pholis ornatus* scarcely at all.

Another specimen (no. 2178), 20.5 inches long, collected by the *Albatross* at Kodiak Island in Uganuk Bay, 1897, differs from current description in that the pectoral does not reach the anal by a distance equal to length of second dorsal spine, and the preopercular spine is not longer but slightly shorter than diameter of eye.

The collection contains 24 additional specimens collected by the *Albatross* at dates other than 1903. These vary from 2.75 to 18.5 inches in length, and were taken at Sucia Island; Promise Island; Mary Island; Nichols Bay; Hunters Bay; Niblacks Anchorage; Sitka; Litnik Bay; Uganuk Bay; Kyska Island, and Atka Island. Four small specimens were collected by Mr. M. C. Marsh at St. Paul Island in 1906.

This species was originally described from the Aleutian Islands by Pallas (1811). Bean (1880) records it from Unalaska, and (1882) from Wrangell; Sitka; Port Mulgrave, Yakutat Bay; Refuge Cove, Cook Inlet; St. Paul, Kodiak Island; Humboldt Harbor, Pirate Cove and Popof Island, Shumagins; Iliuliuk and Chernofski, Unalaska; Nazan Bay, Atka; Amchitka; Port Moller and Cape Lisburne; also (1884) from Mary Island; Makushin Bay; Unalaska Harbor; near mouth of Unalaska River; Shaw Bay, Unimak Island; and Herendeen Bay. Gilbert (1895) records it from a number of stations in Bristol Bay. Turner (1886) records it from the Aleutian Islands: Scofield (1899) from Chignik Bay; Rutter (1898) from Karluk, and Nelson (1886) from Unalaska.

133. **Myoxocephalus jaok** (Cuvier & Valenciennes).

Two specimens, 11 and 9.5 inches, respectively, collected at Tareinski Harbor, Kamchatka, June 21, 1901. The following description is taken from the larger example:

Head 2.5 in length; depth 6.2; eye 6.5 in head; snout 3.75; maxillary 2.1; mandible 2.1; interorbital equal to eye; dorsal viii, 15; anal 14; pectoral 18; caudal with 9 forked rays; ventral i, 3; lateral line about 46.

Body elongate, somewhat depressed anteriorly, terete posteriorly; caudal peduncle stout and short, flattish above and below; head long, its profile nearly straight, a depression between eyes and the sharp high nasal spines, a very prominent rounded projection between the latter, into which the premaxillary projects, the outline from this projection to snout straight and steep; snout somewhat acute; mouth large, gape extending to below middle of pupil; maxillary extending a distance equal to pupil beyond posterior margin or orbit, its breadth 1.3 in eye, its edge slipping somewhat under the preorbital and its body as a whole fitting into a depression in the cheek so that its surface is on a level with the cheek, thus matching the rest of the cheek in surface and color; maxillary inconspicuous; upper lip a broad, high fold, lying well back over the anterior edge of maxillary; teeth small, sharp, in broad villiform bands in jaws, the inner rows somewhat larger, sharper, these depressible and pointing backward; band of teeth in upper jaw interrupted by a narrow mesial fold; teeth on vomer in a rather large V-shaped patch, the teeth larger than those of jaws; palatines toothless; tongue large, bluntly round.

Anterior nostril in front of eye and considerably below nasal spine, posterior nostril a prominent tube above and behind anterior nostril and midway between nasal spine and eye; interorbital space rather broad, concave, continuous with the somewhat broader and flatter occipital space; nasal spines high and sharp, supraoccipital ridges high, terminating posteriorly in a rather blunt conical postocular spine, this with a smaller tubercle in front, several short ridge-like tubercles behind them; parietal ridges prominent converging posteriorly, terminating in rather sharp backwardly projecting spines, on the outer side of this ridge a concave depression bounded by a broken elevated ridge; suborbital stay prominent, slender, long, striate, extending from beneath eye nearly to root of upper preopercular spine; preopercular spines 3, the upper much the longer, about equal to eye, pointing backward and slightly upward, covered with skin nearly to the tip; second spine conical, acute, not half as long as upper, pointing backward and somewhat outward; lower spine stout, short, pointing downward and forward; opercular spine short, stout, and sharp, terminating a long high ridge, which extends anteriorly almost to base of opercle, preopercular flap extending some distance beyond the spine; scapular spine short, sharp, and stout, terminating a high ridge, at the base of which is a small tubercle; gills with a long slit behind the last.

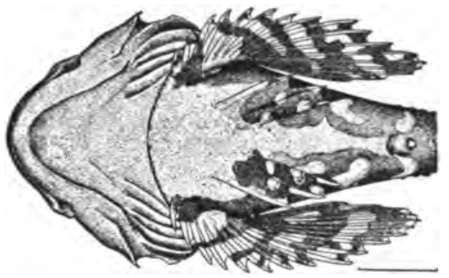


FIG. 68.—Myoxocephalus jaok (Cuvier & Valenciennes).

Origin of spinous dorsal on a vertical with tip of scapular spine, the base 2.3 in head, the third spine longest, 3.6 in head, the membrane reaching nearly to the tips of the spines behind, somewhat scalloped between them, the margin of the fin straight, descending regularly from the third to eighth, which is very short and without free margin; space between spinous and soft dorsals 2 in eye, base of soft dorsal 1.5 in head, its rays about equal, except a few of the last, the longest rays 3.1 in head, none of the rays projecting beyond membrane; contour of fin somewhat rounded in front, upper margin straight; anal similar to soft dorsal, its origin under base of third dorsal ray, its base 2.1 in head, its median rays about 3.75 in head; caudal truncate, tips of the rays slightly projecting; pectoral broad, rounded, the rays stout and simple, the lower somewhat stouter and much shorter, acute, somewhat free at tips, the broad procurrent base well covered by the gill-membranes, length of fin 1.75 in head, its tip scarcely reaching vent; ventrals 3.1 in head, narrow, inner rays longest, tips reaching half way to vent.

Body naked, a row of stellate disks above and quite near to lateral line, an irregular patch of similar but smaller disks in axillary region, extending backward in a single row, but becoming mere sharp prickles posteriorly; top and sides of head covered as far back as base of dorsal with small warty prominences, those in occipital region depressed and crater-like at the top, those in the latero-occipital pits rounded; no cirri.

General color in alcohol: Above brownish olivaceous, irregularly blotched and speckled with black, especially above the pectoral, belly white; head conspicuously speckled with black dots, especially on cheeks and interorbital; occiput dark, upper lip blackish, edge of lower lip black; pectoral irregularly mottled with black, the black spots tending to arrange themselves in crossbands; dorsals faintly mottled with dusky; caudal with 2 irregular faint cloudy bars; ventral with 3 black blotches, the anterior somewhat more distinct, these blotches tending to form 3 faint bars; ventrals pale; peritoneum silvery.

Another specimen, 15 inches long, from Albatross station 3250, Bering Sea, June 13, 1890, had the under part of the pectoral rays covered with sharp tubercles.

No. 2408, a specimen 9 inches long, collected in Unalaska, July 2, 1900, while agreeing in general appearance with typical *jaok*, differs in having the supraoccipital tubercle elongated into a rather long, sharp ridge more or less rough on the edges and inclined to be broken up into a series of tubercles. This tubercle is apparently quite variable, as in another specimen the left tubercle is preceded by a smaller one.

Previously recorded by Bean (1882), as *Cottus humilis*, from Chamisso Island, Eschscholtz Bay. Gilbert (1895), St. Michael and Point Belcher, Arctic Ocean. Townsend (1887), Nushagak River; stations 3290, 3228 to 3230, 3233, 3244 to 3245, 3248 and 3250, all in Bristol Bay; Cape Prince of Wales. Nelson (1887), as *Cottus tænioptcrus*, St. Michael. Nelson (1887), as *Cottus humilis*, St. Michael. Turner (1886), as *C. humilis*, St. Michael. Scofield (1899), Port Clarence and Grantley Harbor.

This species reaches a length of 18 inches and occurs in shallow water everywhere about Bering Sea, extending into the Arctic and south to the Amur River and Unalaska.

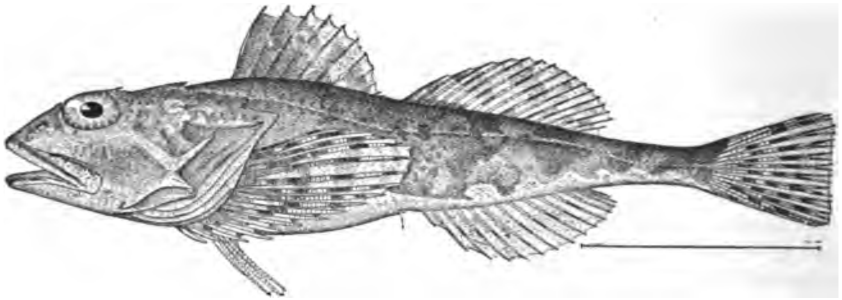


FIG. 69.—Myoxocephalus verrucosus (Bean).

134. **Myoxocephalus verrucosus** (Bean).

One example, 15 inches long, seined at Litnik Bay August 3, and another of same size collected by Luttrell at Sitka. This species was previously recorded from Unalaska and Bristol Bay (Gilbert 1893), and Kings Island, Port Clarence, and Grantley Harbor (Scofield 1896). One specimen from Litnik Bay has the following characters:

Head 2.33 in length; depth 4.16; eye 6.4 in head; snout 3.5; maxillary 2.20; mandible 2.16; interorbital 1.1 in eye; dorsal x-16; anal 13; pectoral 18; branchiostegals 6.

Body stout, tapering to stout caudal peduncle; both dorsal and ventral contours nearly straight; head large, flattened above, but not so manifestly depressed and widened as in many cottoids; mouth horizontal, rather large, the maxillary extending to posterior margin of pupil; mouth cavity large, somewhat dusky; armature of head poorly developed, the spines (nasals, postoculars, occipital and preopercular) short and blunt; short nasal tubes developed; top of head very warty; no filaments anywhere; supraorbital and occipital filaments not present; dorsals not closely connected.

General color darker than in description; the large white spots on belly are also found on pectoral and ventrals; the anal has white bars instead of spots; on the under side of some of the pectoral rays is a series of stiff tubercles, these also found on upper side of ventrals.

135. **Myoxocephalus axillaris** (Gill).

Nelson (1887), St. Michael, as *Cottus axillaris*. Scofield (1899), Port Clarence; Chignik and Herendeen bays. Not seen by us.

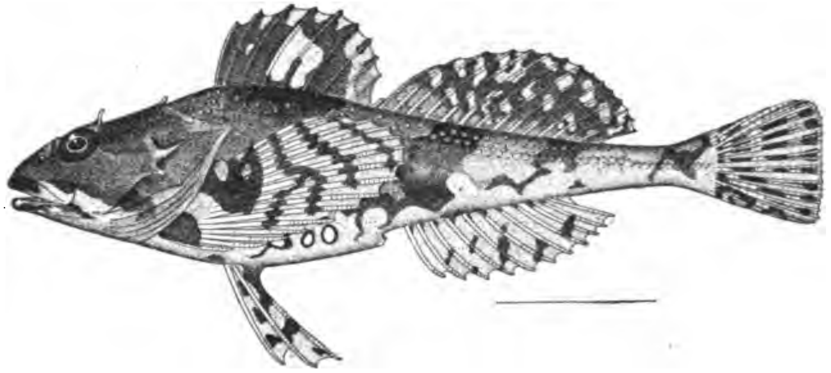


FIG. 70.—Myoxocephalus axillaris (Gill).

136. **Myoxocephalus stelleri** Tilesius.

We have 3 specimens, 10.5 and 5.25 inches long, from Tareinski Harbor, Kamchatka, June 20, 1900, and one 10 inches long from Unalaska, July 2, 1900. Recorded from Point Barrow by Murdoch (1885) as *Cottus decastrensis*.

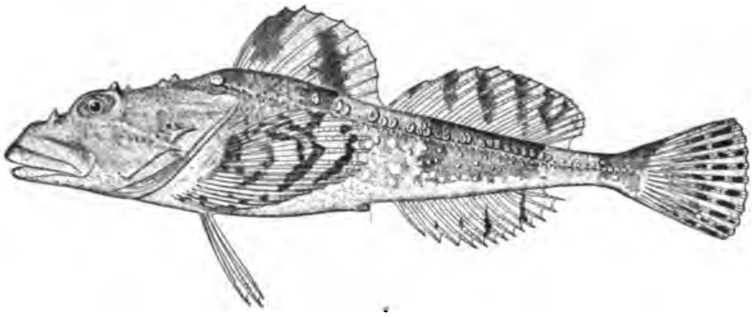


FIG. 71.—Myoxocephalus stelleri Tilesius.

137. **Myoxocephalus niger** (Bean).

We have in our collections 4 specimens 2 to 6 inches long taken by Mr. M. C. Marsh at St. Paul Island, Pribilof Group, July, 1906. Originally described by Bean (1882) from St. Paul Island, Bering

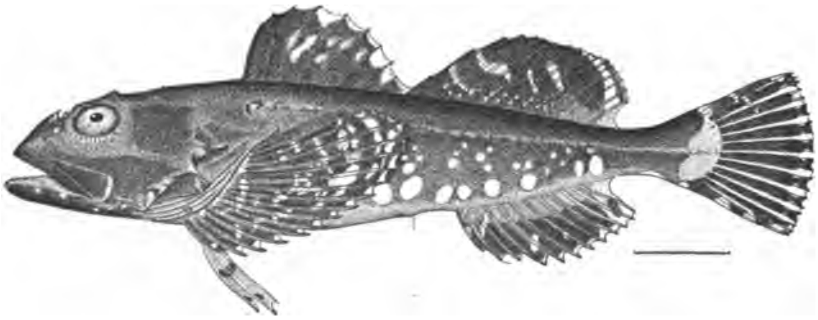


FIG. 72.—Myoxocephalus niger (Bean).

Sea, and recorded by him from Sanborn, Shumagins; also recorded from St. Michael (Nelson 1887 as *Cottus niger*); and from the Pribilof Islands (Jordan & Gilbert 1899).

138. **Megalocottus platycephalus** (Pallas).

No. 2401, a female specimen 13 inches long, with minute eggs, collected at Tareinski Harbor, Kamchatka, June 21, 1900. This specimen appears to be *M. platycephalus*, though differing in some respects from current descriptions.

Head 3 in length; depth 5; eye 6.2 in head; snout 4; maxillary 2; mandible 1.6; interorbital 3.3; dorsal IX-14; anal 12; pectoral 16; caudal 11, 8 of them forked; ventral 3; lateral line 36.

Body depressed anteriorly, subterete posteriorly, dorsal outline nearly straight and horizontal from tip of snout to tip of spinous dorsal when depressed, thence gradually sloping to base of caudal; ventral outline sloping rapidly upward from tip of lower jaw to gill-slits, from thence nearly straight; lower jaw long and projecting, cleft of mouth nearly vertical; contour viewed from above, coffin-shaped, or long kite-shaped, widening rapidly from the tip of the truncate lower jaw to the preopercular spines where it is broadest, from thence tapering gradually to the stoutish caudal peduncle.

Head short, broad, and flat; a large flat, sunken hexagonal area extending from the nasal spines to the occiput, bounded on the sides by the high diverging supraocular and converging parietal ridges; the postocular tubercle high, large and blunt, pointing inward; occipital tubercle prominent, pear-shaped, pointing backward, ending in a stout sharp spine; preopercular spines covered with skin, upper longer than eye, curved upward and inward, second about half as long as first, third spine prominent but blunt, fourth strong, pointing downward and forward; suborbital stay narrow, striate and curved, upper opercular spine short, sharp, stout, almost concealed, pointing backward and downward at the end of a high ridge, the round flap reaching considerably beyond the spine; 2 prominent tubercles at top of gill-slit, these sometimes spinous, and one or more stout suprascapular spines; a strong humeral spine; teeth in strong villiform bands in jaw, a large patch on vomer, none on palatines; tongue large, rounded and prominent; a well-developed symphesial knob; maxillary extending to posterior margin of pupil; a deep cleft behind last gill, slit minute. Spinous dorsal beginning a distance about equal to snout behind tip of gill-flap, its base 1.5 in head, its fourth spine longest, 2.5 in head, its margin rounded, distance between it and soft dorsal equal to eye, latter high, largest ray 1.5 in head, its base 1.1 in head, its margin rounded, somewhat acute behind, the last rays somewhat produced; caudal truncate, 1.5 in head; origin of anal below fourth dorsal ray, base 1.3 in head, rays stout, margin somewhat emarginate (scalloped), longest rays about 2.1 in head; pectoral very broad, the lowest rays short and stout, membrane between them deeply incised, general outline rounded, upper ray short, base procurrent along the edge of gill opening, length slightly longer than head, tip barely reaching origin of anal; ventrals acute, outer ray stout, inner produced, length 1.2 in head, tips not reaching vent by a distance greater than snout; skin naked; top of head warty, sides naked, no flaps anywhere; a row of prominent prickly tubercles between lateral line and dorsal; a few irregular small tubercles in a row beneath lateral line posteriorly.

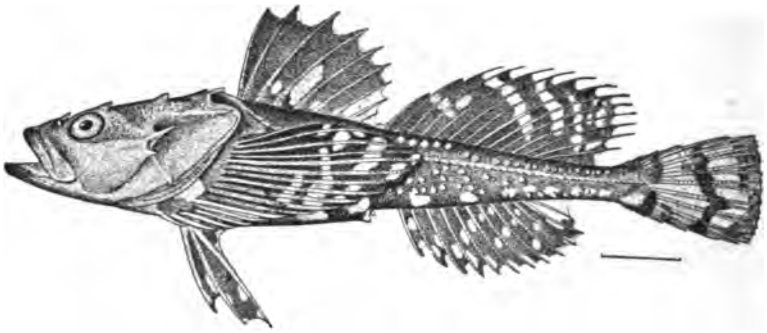


FIG. 73.—Megalocottus platycephalus (Pallas).

Color in alcohol: Above uniform brown, sides below olivaceous, belly white; lower lip and chin uniform black; membranes of upper lip dusky, lower side of lower lip white, the exposed portion all black; isthmus and edge of gill-cavity dusky; vertical fins irregularly mottled and blotched white and brown; inside of pectoral marked with broad brown and narrower white crossbars, outside similarly marked but not so distinctly; ventral with 2 or 3 irregular brown crossbars with narrow white interspaces; peritoneum white.

These characters are probably sexual or are explained by the large size of this specimen.

The collection contains also no. 2394 and 137, 8.5 and 7.5 inches long, collected at Petropaulski, 1900; no. 2404, a specimen 9.5 inches long, no locality, probably off Kamchatka.

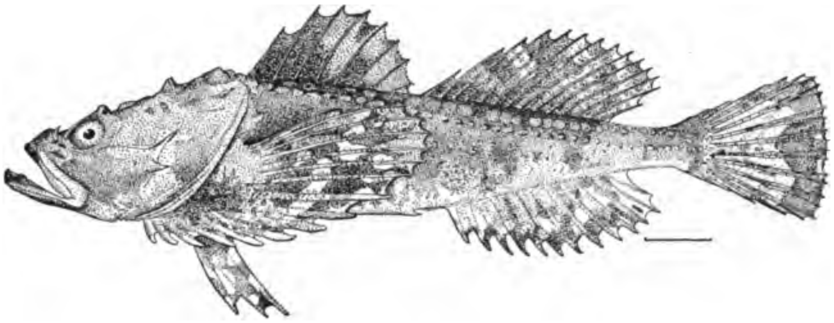


FIG. 74.—Megalocottus laticeps (Gilbert).

139. **Megalocottus laticeps** (Gilbert).

Described originally (Gilbert 1895) from Nushagak River and Herendeen Bay. Recorded (a; *Cottus tænioptcrus*) by Bean (1882) from Point Belcher, Arctic Ocean; Hagmeister Island, Bering Seas and St. Michael. Turner (1886), Norton Sound, and Scofield (1899), Port Clarence. No specimens obtained by us.

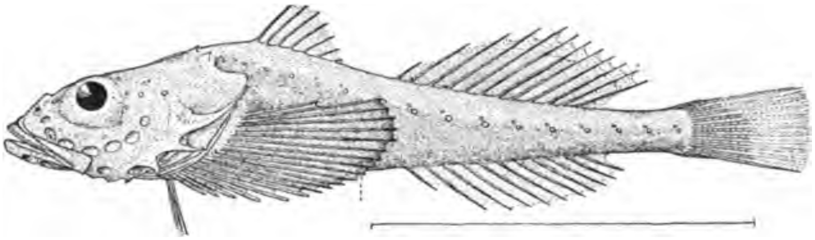


FIG. 75.—Zesticelus profundorum (Gilbert).

140. **Zesticelus profundorum** (Gilbert).

Originally described by Gilbert (1895) as *Acanthocottus profundorum* from station 3329, north of Unalaska.

141. **Thecopterus aleuticus** Smith.

Described from Albatross station 3785, in Bering Sea, 150 miles north of Rat Islands, at a depth of 270 fathoms. Only the type known.

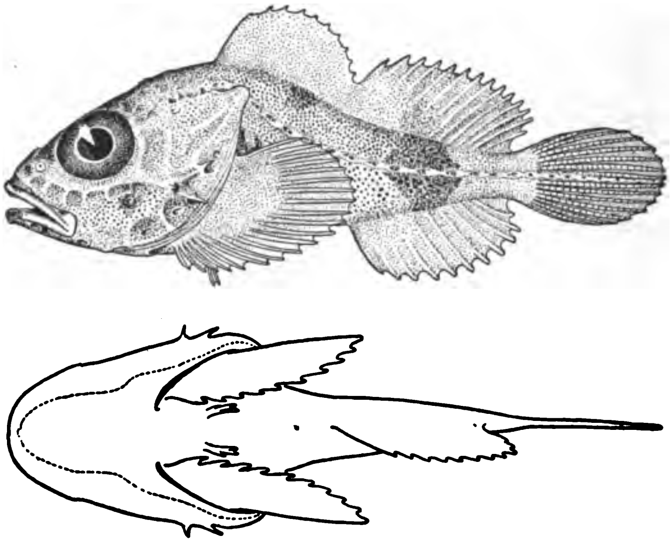


FIG. 76.—Thecopterus aleuticus Smith. Type.

142. **Dasycottus setiger** Bean.

One specimen 3.25 inches long, collected by the *Albatross* at station 3602, Bering Sea; 36 specimens from 1.2 to 8 inches in length from stations 4223 in 48 fathoms; 4237 in 194 fathoms; 4248 in 71 fathoms; 4250 in 66 fathoms; 4254 in 45 fathoms; 4275 in 35 fathoms; 4280 in 32 fathoms; 4281 in 42 fathoms; 4286 in 57 fathoms; 4287 in 66 fathoms; 4288 in 67 fathoms; 4290 in 99 fathoms; 4295 in 92 fathoms; 4296 in 35 fathoms. Besides the above, specimens were seen at stations 4191, 4220, and 4298.

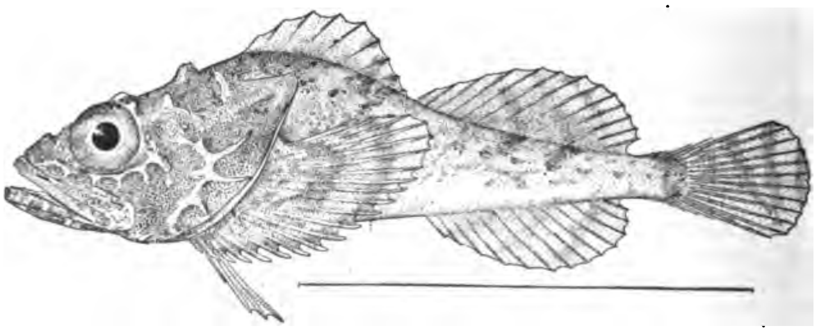


FIG. 77.—Dasycottus setiger Bean.

In the young (1 inch) the eye is round, not elongate; spines on head not so prominent, color darker.

Originally described by Bean (1891) from Albatross station 2855, off Sitkalidak Island. Recorded from stations 3216, 3257, 3310, 3311, and 3324, north and south of the Alaskan Peninsula and north of Unalaska Island (Gilbert 1895), and off Karluk (Jordan & Gilbert 1899).

143. **Malacocottus zonurus** Bean.

The collection contains the following specimens of this species: 4 from station 4253, 1 from station 4232, 3 from station 4230, 1 from station 4198, and 1 from station 4292. Others were seen at St. Mary's Mission, mouth of Oat Bay, at Boca de Quadra, and at Kasaan Bay. These specimens range in length from 2.75 to 7.5 inches, and agree well with current descriptions. The key in Fishes of North and Middle America, however, is defective, in that it would require this genus to have the gill-membranes free from the isthmus, which, of course, is not the case.

Originally described by Bean (1891) from Albatross station 2853, off Trinity Islands. Recorded by Gilbert (1895) from stations 3227, 3330, and 3331, north of Unalaska, and from stations 3337 and 3339, south of Unima Pass.

144. **Porocottus sellaris** (Gilbert).

Described by Gilbert (1895) as *Acanthocottus sellaris*, from stations 3229 to 3234, 3244, 3247, and 3300, all in Bristol Bay.

145. **Porocottus quadrifilis** Gill.

Recorded from St. Michael and Kegiktowik (Nelson 1887).

146. **Porocottus bradfordi** Rutter.

The collection contains 27 specimens collected at Karluk Beach, June 8–10, 1903, and no. 2223, also from Karluk, 1903.

Originally described by Rutter (1899) from Karluk.

147. **Oncocottus quadricornis** (Linnæus).

Recorded from Point Barrow and Meade River (Murdoch 1885), and St. Michael (Nelson 1887), as *Cottus quadricornis*.

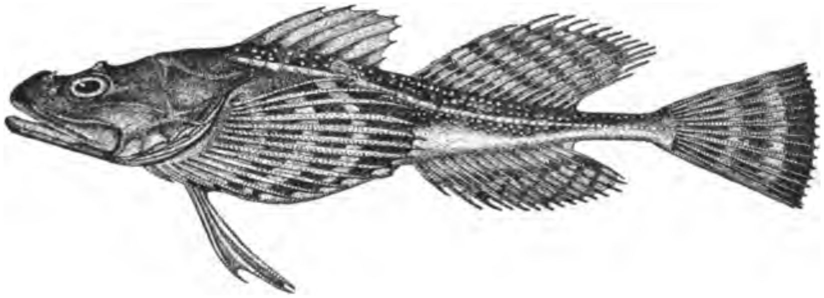


FIG. 78.—Oncocottus quadricornis (Linnæus).

148. **Oncocottus hexacornis** (Richardson). (Pl. XVII, fig. 2.)

Recorded from Herschel Island and Grantley Harbor (Scofield 1896).

We have 3 specimens which we provisionally identify with this species: no. 90, 91, and 92, 8 to 9 inches long, collected by Dr. Gilbert from a salmon trap at Graveyard Point, Kvichak River, near Koggiung, July 16, 1903.

Head 3.16 in length; depth 5.75; eye 6.8 in head; snout 4.75; maxillary 2; mandible 1.9; interorbital 6; dorsal VIII–14; anal 14; ventral I, 3; pectoral 17; branchiostegals 6.

We have also a specimen 2 feet long, no. 2179, collected by the *Albatross* in Uganik Bay, Kodiak Island. As it differs somewhat from the above and from current descriptions of the species, we give a full description of it:

Head 2.75 in length; depth 5.25; eye (orbit) 8.55 in head (orbital rim 6.2); snout 3.3; maxillary 1.66; mandible 2; interorbital broader than length of orbit but not equal to orbital cavity, 2 in snout; dorsal IX-14; anal 13; pectoral 19; ventral I, 3; caudal 9 forked rays; branchiostegals 6.

Body elongate; ventral outline straight; dorsal outline from tip of snout to end of spinous dorsal gently arched and slightly bulging, from there to base of caudal straight, the head, however, slightly depressed; posterior part of body somewhat compressed; caudal peduncle rather long but stout, its length 1.1 in snout, its depth about half its length.

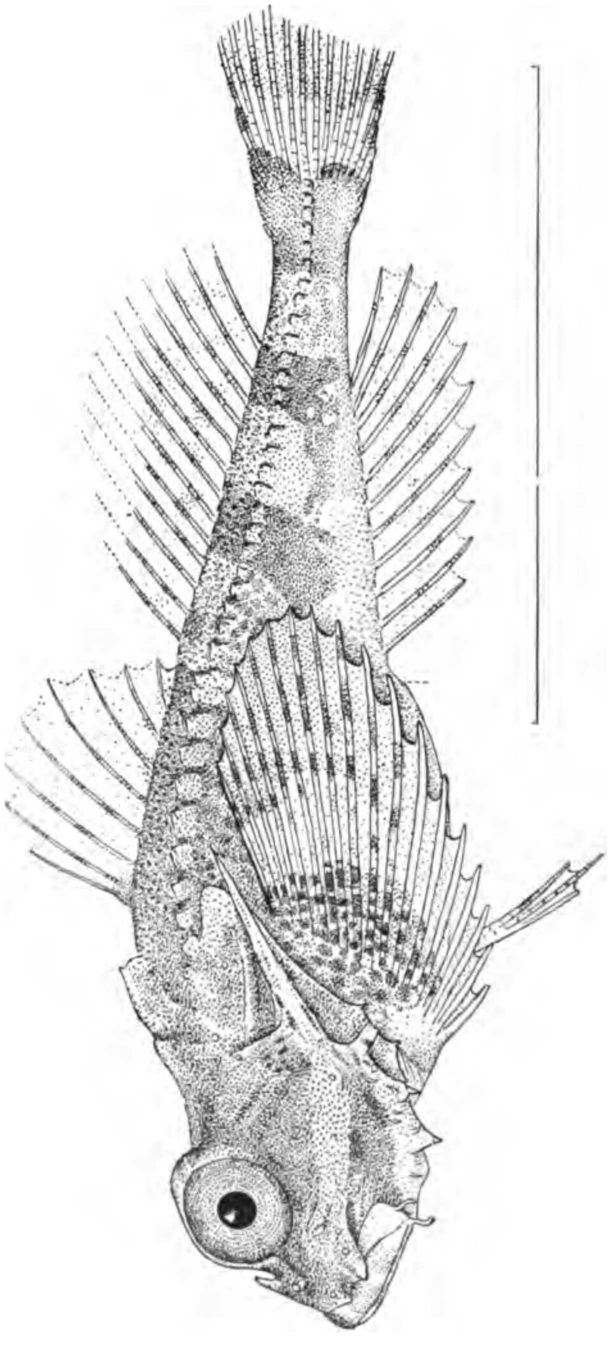
Head large and broad, the snout rather blunt, its anterior profile a straight slope from the prominent tubercle of the premaxillary pedicel; mouth wide and capacious, the gape extending to below pupil, the maxillary to posterior margin of orbit rather narrow, its width at end about 1.5 in orbit; mouth oblique, the upper edge of premaxillary below level of lower margin of orbit; teeth in jaws in broad villiform bands, the band of lower jaw a trifle broader behind, that in upper jaw widening in front, terminating on each side of the symphysis as a rounded lobe, a narrow mesial toothless ridge in each jaw; teeth of both jaws immovable, pointing inward; vomer with a broad V-shaped band of teeth, the arms of the V rounded; no teeth on palatines; lower jaw included, its band of teeth shutting inside those of the upper jaw; premaxillary separated from maxillary by a deep furrow; upper lip a narrow continuous ridge, followed by a high ridge of skin, which usually lies back toward the maxillary; lower lip a high thin fold at the sides, growing thicker in front and interrupted mesially by a broad frenum; a rather prominent, rounded knob at symphysis of lower jaw.

Gill-membrane forming a rather thick but shallow fold across the isthmus; gills 4, the slit behind the fourth represented by a very small pore on the left side, on the right no opening evident; gillrakers represented by broad, low, rounded tubercles, which are very hispid and rough to the touch, like shagreen; head with a few spines and various ridges; nasal spines short, stout, sharp, pointing backward, the distance between them about two-thirds orbit; supraocular ridge beginning as a large raised area in front of eye, continued backward as a blunt high ridge, widening posteriorly and terminating in a rather high rough postocular tubercle which ends abruptly; at the base of this, two diverging short ridges between which rise the prominent supraoccipital ridges, these converging backward to the base of the occiput, where each ends in a raised elongate very rough tubercle much like those behind the eye; a broad, diverging, smooth, blade-shaped ridge extending from the supraoccipital tubercles nearly to upper angle of gill-slit, and from the posterior end of this ridge, rising at a sudden angle, a posteriorly projecting ridge which ends in the stout, short, scapular spine; a long low ridge below the eye, and another back and behind eye, pointing downward; suborbital stay prominent, running backward nearly to the base of the upper preopercular spine; a high broken ethmoidal ridge running across upper part of cheek, extending from behind eye toward top of gill-slit, and a prominent ridge from a break in its center toward the base of the upper preopercular spine.

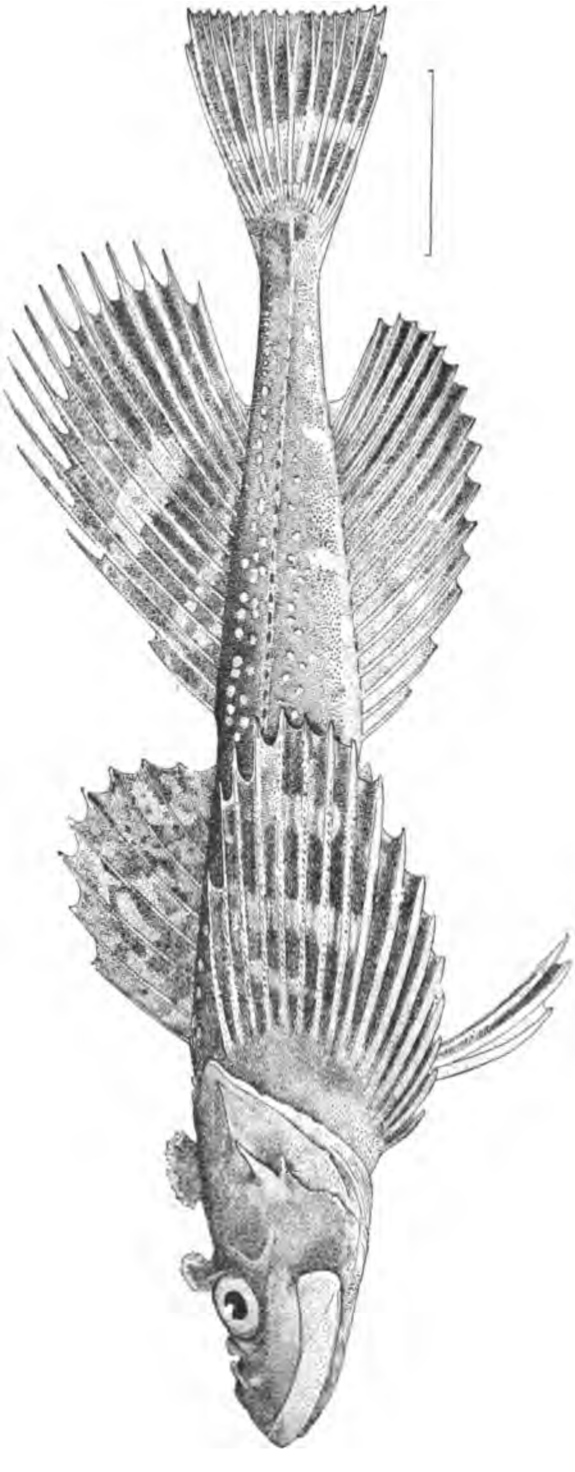
Preopercular spines 4, the upper stout, about as long as orbit, straight, pointing outward and backward, covered nearly to the tip with skin, which is warty or rough papillose at its base; second spine not quite half so long, pointing downward and outward; third spine a prominent tubercle; fourth; stout, sharp, pointing downward and forward, rather remote from the others; opercular spine short and sharp, nearly covered with skin, terminating a long, prominent, striate, rather curved ridge, which is parallel with the upper edge of the opercular flap; opercular flap long, rather thin, extending upward and backward and beyond the spine for a distance nearly equal to diameter of orbit.

Spinous dorsal high, its general contour rounded, its membrane roundly scalloped between the spines, spines long, slender and sharp, the longest (fourth) 3.75 in head, the two spines in front closely approximated, the others rather remote (distance about one-half orbit), the posterior spines shortest, origin of dorsal above suprascapular spine; base 2.25 in head, nearly equal to snout and orbit; interval between spinous and soft dorsal conspicuous, about two-thirds orbit; base of soft dorsal 1.9 in head, its rays long, stout, conspicuously ringed, none of them branched, a few of the anterior shorter, the contour of the fin gently rounded in front and behind, the median portion straight, the margin gently scalloped, the rays not produced, longest rays nearly equal to snout; anal similar in outline to soft dorsal, its membrane, however, considerably thicker, the rays firmer and stouter, ending in rather stout tips; origin of anal below fourth anal ray, anal base equal to a distance from tip of snout to posterior margin of orbit; pectoral very broad, the base procurrent, close to and parallel with the edge of the gill-opening, nearly all the rays, especially the lower, very thick and stout, almost club-shaped and projecting slightly as blunt points beyond the membrane, the lowest very short, gradually lengthening to the first from the uppermost, the uppermost a trifle shorter than second; the three upper rays somewhat slender, displaying the articulations, the others not; longest ray (second) equal to distance from tip of snout to a little beyond posterior margin of orbit, the tip of the fin reaching to end of base of first dorsal but not quite reaching vent; ventral rays and membrane exceedingly thick, the inner ray somewhat the longer, the fin somewhat acute, the greatest length equal to length of snout, the tips reaching about half-way to vent from their base; caudal truncate, fan-shaped, the tips of the forked rays extending beyond tips of membrane as closely approximated points, two near together; peritoneum dusky.

No scales, nearly all of upper part of head as well as tip of maxillary covered with minute wartlike elevations, the lower part of the cheek and a patch above suborbital stay and backward and downward



1. ENOPHRYS CLAVIGER (CUVIER & VALENCIENNES).



2. ONCOCOTTUS HEXACORNIS (RICHARDSON).

from the eye smooth; a patch of minute tubercles along each side of suborbital stay; warts on opercle above opercular ridge minute and collected into patches; below this ridge they are round and flat, collected somewhat into chainlike bands, small patches of minute tubercles extending backward and away from each segment of the lateral line, giving it a somewhat feathery appearance; a line of these small projections terminates the lateral line at the base of the caudal fin; lateral line chainlike, of about 47 jointlike segments.

Color in alcohol dark brown above, much mottled with irregular, small, thickly set white blotches, this color extending up somewhat on the base of the fin membranes; lower half of side paler, consisting of a white ground clouded over with minute brown punctulations; ventral surface, including chin and breast, white; upper lip, maxillary, and membranes of upper jaw slaty blue; dorsal fins irregularly blotched with patches of white and dark brown, the margin of each fin, particularly the soft dorsal, inclined to be wholly white; caudal membranes light at base, the rays dark, this dark color broadening outwardly, making a dark brown band parallel with the edge of the fin, its distal border slightly wavy, its proximal border deeply incised by sharp patches of white projecting out between the rays, the outer margin of the fin wholly white; anal white with 3 dark vertical bars about half as wide as eye, these about equal distances apart, the projecting tips of the rays always white; ventrals pale, mostly cloudy, crossed with indistinct bars of lighter; pectorals dark brown, a few round small spots of white arranged roughly in the form of bars; a narrow margin of the fin wholly white, the upper edge of the fin showing brown regularly crossed by small white dots.

Specimen described a female containing a few small eggs.

This fish has a close general resemblance to *Myoxocephalus polyacanthocephalus*. The presence of a fourth preopercular spine, however, removes it from that genus. The character of the gill slit resembles that of *Myoxocephalus*, but the fourth preopercular spine and other minor characters place it better with *Oncocottus*. Our specimen possesses many characters common to both genera, however, and it may be found that characters which have been considered generic in small individuals disappear in larger ones. The gill slit, for instance, is present on one side and absent on the other in this specimen.

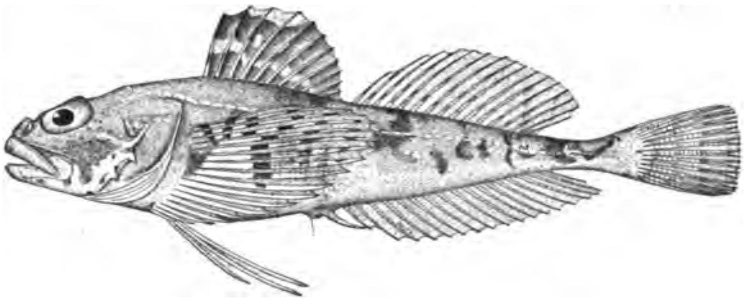


FIG. 79.—Gymnocanthus pistilliger (Pallas)

149. **Gymnocanthus pistilliger** (Pallas).

We have in the collection a specimen 5 inches long, collected at Tareinski Harbor, Kamchatka, June 21, 1900. This species has also been recorded by Bean (1882) from Kyska Harbor and Point Belcher. Gilbert (1895), Bristol Bay at stations 3230 to 3233, 3237 to 3246, 3289, 3291, 3296, and 3300. Scofield (1899), Port Clarence.

150. **Gymnocanthus galeatus** Bean.

Head 3 in length; depth 6; eye 3.6 in head; dorsal XI-16; anal 18; pectoral 19; maxillary 2.4; interorbital 3.1.

The collection contains 25 specimens 1.5 to 11.5 inches long from the following places: Atka Island, 1894; stations 3598, in Bering Sea, and 3653, off Shana, Iturup Island; Akutan Bay; station 4253, Stephens Passage, and with hook and line in Shakan Bay. The specimen (no. 2913) from station 4253 is a female with very small eggs.

Originally described by Bean (1882) from Iliuliuk, Unalaska, and also recorded by him from off Cape Sabine, Arctic Ocean, and from Steamer Bay, Chacan, and Sitka. Chernofski Harbor, Unalaska Island (Gilbert 1895). Port Clarence (Townsend 1887). Point Barrow (Scofield 1899). St. Paul Island (Palmer).

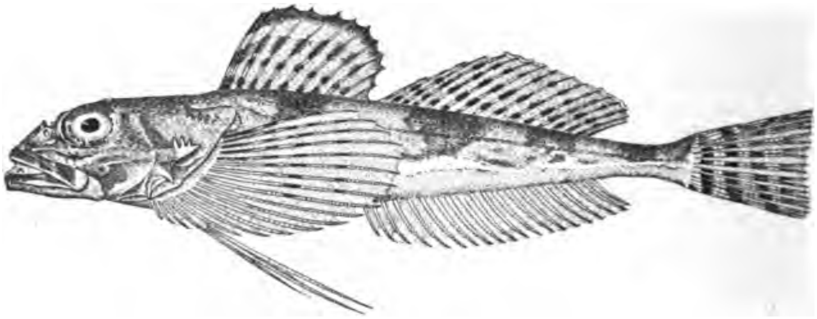


FIG. 80.—Gymnocanthus galeatus Bean.

151. **Leptocottus armatus** Girard.

The collection contains 52 specimens 1.75 to 12 inches long from the following places: Karluk; Gabriola Island; Union Bay; Marrowstone Point; Kilisut Harbor; Mink Arm; Yes Bay; Dundas Bay; Snug Harbor; Yakutat; Hunter Bay; Loring; and Promise Island. Specimens were also seen at Dundas Bay; Nanaimo; Fort Rupert; Metlakahtla; Boca de Quadra; Karta Bay; Sucia Island; Seattle; and Alert Bay. A specimen (no. 2792) 8.75 inches long, gives the following data: Head 2.8 in body; depth 4.75; eye 6 in head; interorbital 5.5; maxillary 2.1; dorsal VIII–17; anal 19; pectoral 18.

The young are exceedingly mottled, and usually with 2 very small white spots on shoulder which disappear with age.

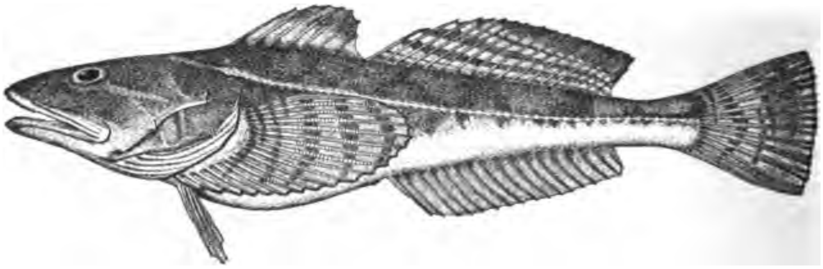


FIG. 81.—Leptocottus armatus Girard.

A specimen 1.5 inches long collected at Promise Island, October 3, 1894, is the smallest specimen we have. It differs somewhat from mature specimens in color, having 3 dark saddle-like crossbars, the first under anterior part of spinous dorsal; second under anterior part and third under posterior part of soft dorsal. Mature specimens can usually be readily recognized by the palmate appearance of the preopercular spines; in successively smaller specimens these gradually become more pinnate. The species is recorded by Bean (1882) from Sitka; Port Mulgrave, Yakutat Bay; and St. Paul, Kodiak Island. Rutter (1899), Karluk.

152. **Oligocottus maculosus** Girard.

The collection contains 13 specimens from Otter Bay, Pendar Island, 1895; 13 specimens from Kilisut Harbor, 108 from Marrowstone Point, 88 from Gabriola Island, 54 from Fort Rupert, 15 from Shakan Bay, and 16 from Point Ellis; no. 2225, a specimen 3 inches long, and 203 specimens collected by Mr. Rutter at Karluk in 1903; 19 specimens collected in 1903 in Naha Bay by Mr. Chamberlain, who also collected 2 specimens in Yes Bay in 1905.

This species has been recorded (Bean 1882) from Sitka; Alexandrovsk, Cook Inlet; Wrangell; Mary Island and Tongass (Bean 1884), and Karluk (Rutter 1899).

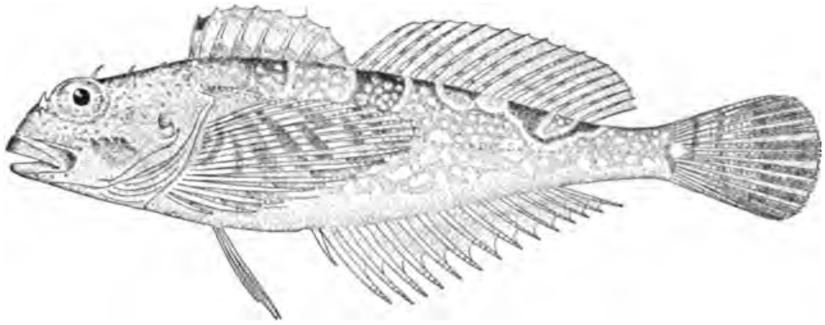


FIG. 82.—Oligocottus maculosus Girard.

153. **Sigmistes caulias** Rutter.

Originally described by Rutter (1899) from Karluk.

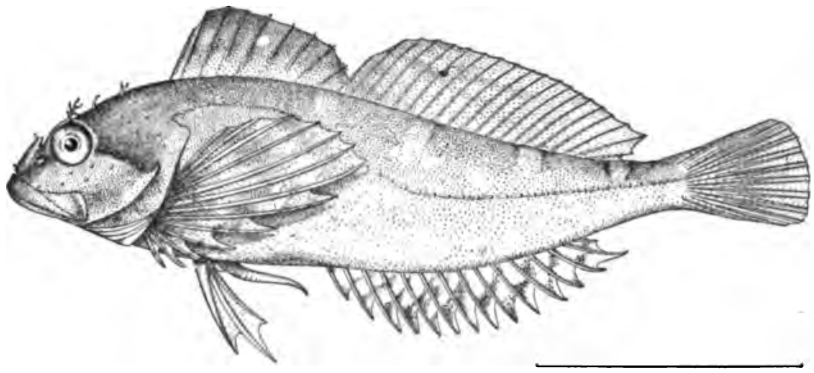


FIG. 83.—Sigmistes caulias Rutter. Type.

154. **Blennicottus acuticeps** (Gilbert).

Head 3.75 in length; depth 5; eye 3.9 in head; snout 4; maxillary 2.5; mandible 2; dorsal VIII–15; anal 11; pectoral 13; ventral I, 3; branchiostegals 6.

Body rather elongate, the dorsal contour arched under the spinous dorsal, tapering behind to a slender caudal peduncle, the least depth of which equals eye; head rather small, its upper profile arched; mouth small, horizontal, maxillary reaching to anterior margin of orbit; teeth in viliform bands on jaws, vomer, and palatines; interorbital rather narrow, concave; snout rather sharp and pointed; nasal spines present, rather strong; one pair of supraorbital and two pairs of occipital cirri, these rather long; preopercle with only one (the upper) spine present, this covered with skin—when exposed it is seen to be rather sharp and stout, curved upward; gill-membranes forming a broad fold across isthmus; no evident slit behind last gill-arch; a rather strong suprascapular spine; spinous dorsal rather high, of uniform height, the slender spines (3 in head) united to their tips by the thin transparent membrane, the base of spinous dorsal a trifle longer than head; soft dorsal somewhat lower, its rays longer than spines, 2.1 in head, but slanting backward when fin is extended; base of soft dorsal 2.75 in head; the anal about the same length; pectoral long, graduated, the lowest rays short and stout, free at the ends and hooked, the fin extending beyond origin of anal, nearly as long as head; ventral 1.5 in head, rather long and narrow, extending beyond vent and nearly to base of anal; caudal somewhat narrow, rounded, its length 1.2 in head.

Color in alcohol slaty blue above, gradually fading to dusky white below; a dusky patch at front edge of dorsal; anal and lower rays of caudal speckled; pectorals dusky; ventrals and soft dorsal plain.

The collection contains 227 specimens varying from 1.5 to 2.5 inches. Two of these were collected by the *Albatross* in 1894, one in Promise Bay and the other at Atka Island. One is a female containing mature eggs the size of mustard seed. The other specimens were collected by Mr. Rutter on the beach at Karluk, June 8–10, 1903.

The following counts of 159 specimens collected at Karluk show the variations in the anal rays: Seven have 13 anal rays, 106 have 12 anal rays, 45 have 11 anal rays, and 1 has 10 anal rays.

These also show great variation in color and in markings, the ground color varying from plain olivaceous to rosy, and some being almost plain, others much speckled and mottled. In all these specimens the 2 black blotches on spinous dorsal are present, but they vary in size and distinctness. In many the tips of the spines project slightly as minute filaments, and the fin is not evenly rounded, being higher in front. In *embryum* the fin is not so high, but is rounded, being higher in the center. This species can not be separated from *B. embryum* on the number of the anal rays, as both frequently have 11, *embryum* usually having 10 or 11 and *acuticeps* varying from 10 to 13.

Described by Gilbert (1893) as *Oligocottus acuticeps*, from Unalaska. Recorded by Rutter (1899), as *Oxycottus acuticeps*, from Karluk.

155. Blennicottus globiceps (Girard).

Recorded by Bean (1881) as *Oligocottus globiceps*, from the following places: Sitka; Shahafka Cove, Kodiak Island; Adak and Amchitka.

156. Blennicottus embryum (Jordan & Starks).

Three specimens (nos. 02224 and 02227), each about 1.75 inches long, collected by Mr. Rutter at Karluk early in July; and 64 specimens 1 to 2.75 inches long, collected by him at Karluk, June 8–10, 1903.

Head 3.33 in length; depth 4.8; eye 3.2 in head; snout 3; maxillary 2.5; mandible 3; interorbital 1.25; dorsal IX, 15; anal 10; branchiostegals 6; pectoral 14; ventral I, 4; pores about 34 (?).

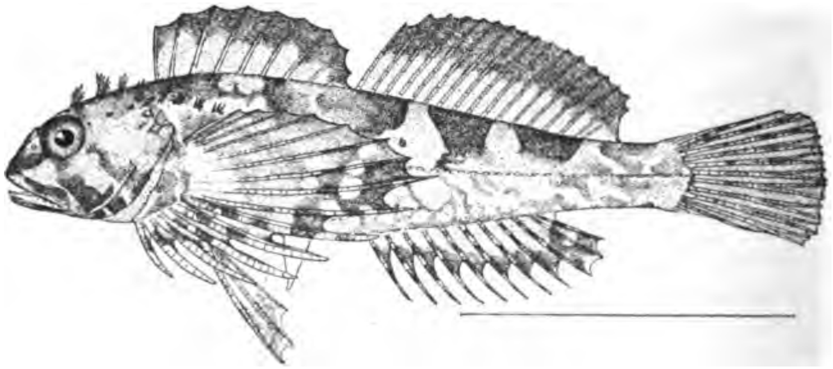


FIG. 84.—Blennicottus embryum (Jordan & Starks). Type.

Body somewhat elongate, tapering to a rather slender caudal peduncle, the depth of which is somewhat more than diameter of orbit; head rather small, compressed, the profile rounded; mouth horizontal, quite small; tip of maxillary reaching slightly beyond anterior margin of orbit; teeth minute, on jaws, vomer, and palatines; nasal spines rather stout; interorbital space rather narrow, concave; apparently no slit behind last gill-opening; preopercular spine single, covered with skin; when dissected out, it is seen to be simple, short, stout, sharp, and slightly curved upward. Spinous dorsal rather low, rounded, its longest spine about 3 in head, its base about equal to head; longest dorsal ray about 1.6 in head; base of soft dorsal about 2.66 in body; pectoral rather broad, acute, about 1.5 times head and extending beyond origin of anal; ventrals long and slender, 1.3 in head, reaching beyond vent nearly to anal; anal papilla prominent in the male.

Color in alcohol: Six saddle-shaped blackish blotches along dorsal, reaching about to lateral line, pale roundish spots between these; lower part of body and all fins but ventrals finely mottled.

157. **Blennicottus clarki** Evermann & Goldsborough, new species.

Head 2.75 in length; depth 5.5; eye 3.3 in head; snout 4.3; dorsal vi–12; anal 12; pectoral 21; ventral i, 3; branchiostegals 6.

Body elongate, slightly compressed, tapering gradually from occiput to narrow caudal peduncle, the least depth of caudal peduncle 1.5 in eye and 2 in its length; vent median, much nearer base of anal than base of ventral.

Head rather large, somewhat depressed; snout bluntly rounded from above, its anterior profile gently rounded; mouth horizontal, tip of premaxillary below lower margin of orbit, maxillary reaching vertical at middle of pupil; teeth minute on jaws, those on vomer and palatines barely discernible; nasal spine short, sharp, and weak; interorbital very narrow, not evidently concave, about 4 in eye; occiput with 2 faint ridges, area between them somewhat concave; opercle thickened above, ending behind in a round lobe; 2 preopercular spines, the upper simple, stout, curving upward and inward, covered with membrane, the lower, on lower limb of preopercle, short, directed downward and forward; no evident nasal cirri, and none evident on lateral line; a strong cirrus on tip of maxillary, a small one near base of upper preopercular spine, and a small one on opercular flap, one on shoulder above base of pectoral, rest of body smooth without further cirri or other prickles.

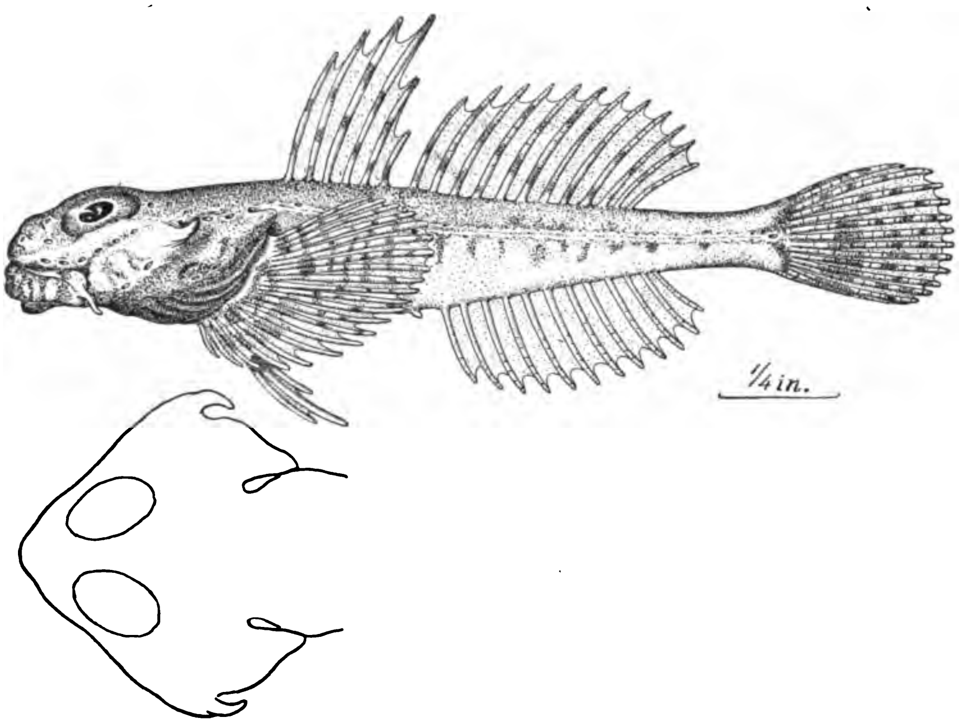


Fig. 85.—Blennicottus clarki Evermann & Goldsborough, new species. Type.

Origin of dorsal over upper base of pectoral, spines rather high, second, third, and fourth highest, about 1.4 in head, free at tip, the tips slightly club-shaped; interval between spines very short; soft dorsal nearly as high as spinous dorsal, the middle rays highest, about 2 in head; caudal rounded, long and narrow, 1.3 in head; anal similar to soft dorsal; ventrals long and narrow, reaching nearly to vent, 2 in head; pectoral broad and falcate, upper rays longest, reaching beyond origin of anal, its base strongly procurrent, parallel with gill-cleft and close behind it, length from lower edge of axil to tip about 1.1 in head.

Color in alcohol brownish-olivaceous on upper part of side, mottled with small white spots; occipital and interorbital region darkest, region above lateral line light olivaceous; an indistinct darker bar under spinous and a similar one under middle of soft dorsal, a dark blotch at base of caudal; dorsal, caudal, and pectoral indistinctly blotched and mottled with brown, these tending to form bands; a dark area at base of pectoral; anal and ventral plain.

This species is most closely related to *Blennicottus acuticeps*, from which it differs markedly in having a blunter snout, narrower interorbital, larger head and eye; fewer dorsal spines and rays; no nasal cirri and none on lateral line.

Type no. 57824 U. S. National Museum, a specimen 2 inches long, collected by the *Albatross* at station 3598, Bering Sea, June 8, 1894. We have 1 other specimen, 1.2 inches long, from same place.

Named for our friend and associate, Mr. H. Walton Clark, of the Bureau of Fisheries, in recognition of his valuable assistance in the preparation of this report.

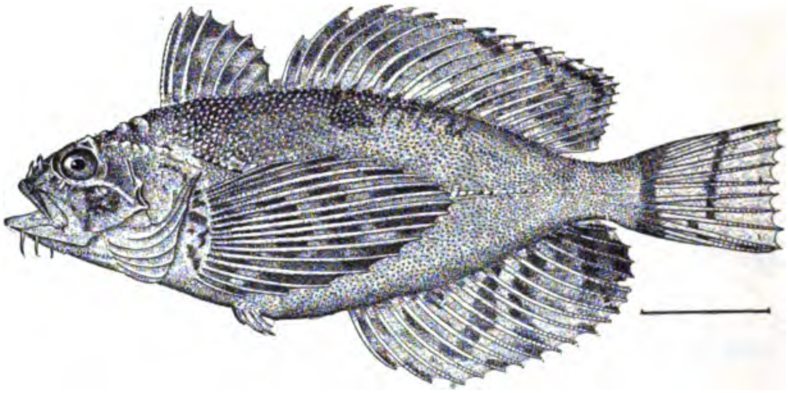


FIG. 86.—Histiocottus bilobus (Cuvier & Valenciennes).

158. **Histiocottus bilobus** (Cuvier & Valenciennes).

We have 4 specimens 9 to 10 inches long from Karluk; 1 specimen 6 inches long from station 4259; and another 6 inches long, Tongass Narrows, October 28, 1905. It is recorded by Bean from St. Paul, Kodiak, as *Blepsias bilobus.*

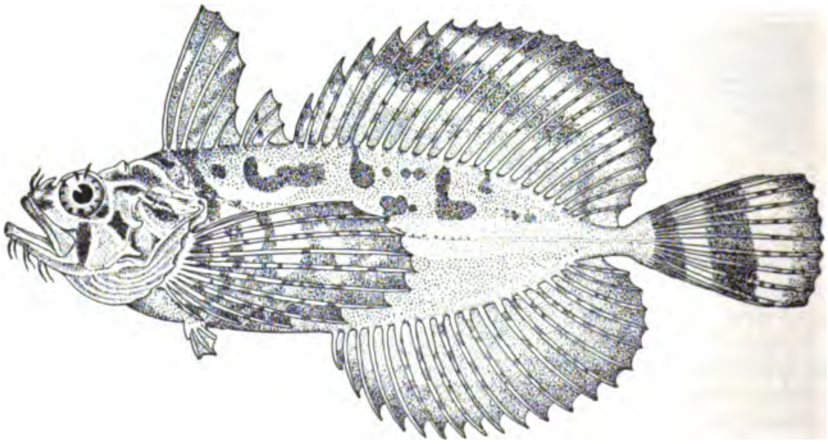


FIG. 87.—Blepsias cirrhosus (Pallas).

159. **Blepsias cirrhosus** (Pallas).

Ninety-five specimens of this species were taken at various points from Puget Sound to Kodiak Island. They range in length from 1.25 to 7.5 inches and were taken at the following places: Marrowstone Point; Kilisut Harbor; Fox Bay; Alert Bay; Cleveland Passage; Metlakatla; Killisnoo, and on the beach at Karluk. A female 6 inches long, seined at Marrowstone Point June 29, was ripe with eggs of good size (larger than shad eggs) and of bright rosin color. Fifty-six of the specimens were taken at Karluk by Mr. Rutter. These were 1.25 to 1.8 inches long, and the dorsal counts in many of them were IV, III-24; the young have a distinct color pattern, showing the pale blotches on fins very distinctly. These blotches are not so distinct on larger examples, indicating that the young are much more brilliantly colored.

Recorded by Bean (1882) from Sitka; Port Mulgrave, Yakutat Bay; Iliuliuk and Chernofski, Unalaska; Bay of Islands, Adak; Kyska, and St. Paul Island. Gilbert (1895), Unalaska.

160. **Nautiscus pribilovius** Jordan & Gilbert.

Recorded by Bean (1882) from Unalaska, Adak, Kyska, and St. Paul, Kodiak Island, as *Nautichthys oculofasciatus*; under the same name by Gilbert (1895) from Bristol Bay and south of the Alaskan Peninsula at stations 3213, 3217, 3220, 3222, 3231, to 3234, 3236, 3246, 3274, 3281, 3290 to 3294, 3296, 3300, and 3302. The species was described by Jordan & Gilbert in 1899, the type coming from St. George Island and a cotype from Unalaska.

161. **Nautichthys oculofasciatus** (Girard).

One specimen 4 inches long from station 4209, Admiralty Inlet; 1 specimen 4.3 inches long from station 4219, mouth of Oak Bay.

162. **Ulca marmorata** (Bean).

A specimen (no. 2917) 12.5 inches long from station 4255, Chilkoot Inlet, is described as follows:

Head 2.6 in length; depth 5; eye 5.5 in head; snout 4; maxillary 1.5; mandible 1.28; interorbital 2.5; length of middle pectoral rays 1.5; second dorsal spine, including filament, 2.5; longest dorsal ray 2.6; caudal 2; longest anal rays 2.7; ventrals 3.1.

Head very broad, depressed, the body tapering gradually to the slender caudal peduncle; mouth large, oblique, the maxillary extending beyond pupil; the mandible strongly projecting; teeth very strong on jaws, vomer, palatines, premaxillaries, and tongue, many of them enlarged and canine-like; head very rough, with numerous large bluntish spines, those on supraocular and occiput largest and strongest; one large blunt spine at upper angle of opercle followed by a long curved ridge; preopercle with 4 blunt diverging spines, the second one from top longest; opercle with a strong ridge; interorbital very broad and concave; body everywhere, especially above, covered with low blunt tubercles; under parts with soft tubercles; lower jaw with numerous cirri, some of them branched, nearly equaling eye in length; numerous smaller cirri on upper part of head and anterior part of body. Fins well developed, dorsal spines long, ending in filaments; soft dorsal higher than spinous portion; anal rays somewhat enlarged; pectoral very large, nearly reaching beginning of anal.

Besides this large specimen the collection contains 4 smaller ones, as follows: One 1.8 inches long, dredged at station 4270, Litnik Bay; one 2.25 inches long, dredged at station 4281, Chignik Bay; one 2.6 inches long, dredged at station 4279, Alitak Bay; one 3 inches long dredged at station 4293.

Originally described by Bean (1891), as *Hemitripterus marmoratus*, from Albatross station 2855, off Sitkalidak Island. Recorded by Gilbert (1895) under the same name from stations 3224, 3257, 3258, and 3311 in Bering Sea, north of Unalaska Island.

163. **Hemitripterus cavifrons** Lockington.

We have in the collection a single specimen 8.5 inches long, collected by the *Albatross* at Petropaulski, June 20, 1903. Recorded by Bean (1882) from Kodiak as *Hemitripterus americanus*.

164. **Synchirus gilli** Bean.

One specimen 1.5 inches long picked off an anemone at Quarantine Dock, Port Townsend, June 27, 1903.

Dorsal IX-20; anal 20. No spiny tubercles on lateral line; no series of spiny scales along dorsal base.

165. Psychrolutes paradoxus Günther.

Eighty-seven specimens, from 0.75 to 2.4 inches long, were secured by the *Albatross* in Otter Bay, May 31, 1895, and at stations 4223, 4228, 4257, 4270, 4271, 4273, 4274, 4275, 4283, 4285, 4290, 4291. These stations range from Puget Sound to Kodiak Island.

Recorded by Bean (1882) from Kodiak Island. Gilbert (1895), as *Psychrolutes zebra,* from stations 3213, 3215, to 3217, 3219, 3222, to 3225, 3257 to 3259, 3263, 3265, 3272, 3310, 3311, 3313, 3322, 3334, in shallow water south of the Alaskan Peninsula, thence west to and through Unimak Pass, along the northern shore of Unalaska Island and in Bristol Bay. Under the same name by Bean (1891) from station 2848, between Unga and Nagai islands. Jordan & Gilbert (1899), stations 3640 off St. Paul Island and 3674 off Kodiak Island at Karluk.

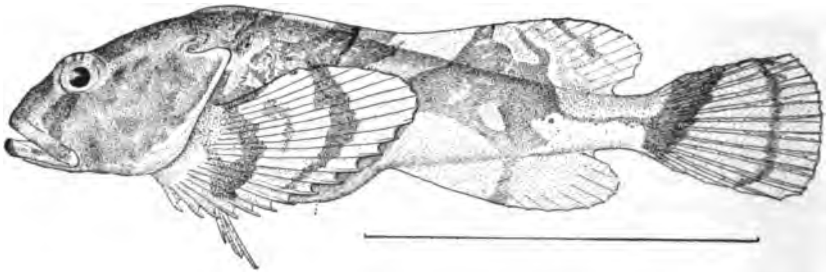


FIG. 88.—Psychrolutes paradoxus Günther.

166. Gilbertidia sigolutes (Jordan & Starks).

Head 2.7 in length; depth 3; eye 4.7 in head, equaling snout; interorbital 2; width of mouth 2; dorsal VI, 21; anal 15; pectoral 15; ventral 3.

Body short and tadpole-like, tapering rapidly from the very large head to the narrow caudal peduncle; head very large, globular; snout short and evenly rounded; interorbital very broad, gently convex; mouth large, broad, jaws subequal; maxillary slender, weak, reaching front of eye; teeth in jaws weak, apparently in a single row; vomer and palatines toothless. Dorsal fin much larger than anal, partly concealed by loose skin; spinous dorsal entirely obliterated except the tips of the last 3 spines, which project above the skin as mere tubercles; origin of anal nearly under fourth dorsal ray; tips of last dorsal and anal rays overlapping base of caudal fin; caudal fin evenly rounded; pectoral well developed, its upper rays longest, reaching origin of anal fin, the lower rays somewhat enlarged, their tips free; ventrals small, short, barely reaching vent; nostrils with conspicuous nasal flaps; lower jaw, side of head, and side of body above pectoral fin with conspicuous mucous pores.

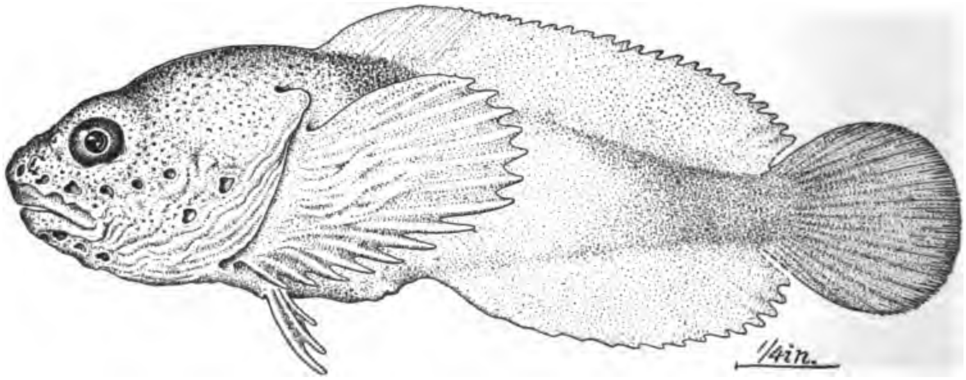


FIG. 89.—Gilbertidia sigolutes (Jordan & Starks).

Color in alcohol, brownish white; the back in front of dorsal crossed by a broad bluish band; region under pectorals and ventrals bluish; head everywhere above finely punctate with brownish; under part of head whitish; fins all plain bluish white.

One specimen, 2.5 inches long, was dredged at station 4256, in 73 fathoms, in Chilkoot Inlet, July 16, 1903, and a specimen $1\frac{1}{16}$ inches long, at station 4257, off Funter Bay. Two specimens, each about 1.5 inches long, were seined at Loring, April 25, 1903, by Mr. Chamberlain.

Family 34. RHAMPHOCOTTIDÆ.

167. **Rhamphocottus richardsoni** Günther.

The collection contains the following specimens:

Two collected by the *Albatross* in Straits of Fuca (1891); 2 seined at mouth of Hood Canal; 5 from stations 4197, 4204, 4205, 4209, 4212. These differ from current descriptions in that the tubercles are simple and prickly, but not bifid or trifid. Dorsal spines not always VII, sometimes VIII, and in one case VII–II; first pectoral rays and the dorsal rays prickly for their whole length; black spot not always present on all the dorsal rays. There are numerous tubercles on upper half of membrane of eye.

This species was recorded from St. Paul, Kodiak Island, by Bean (1882).

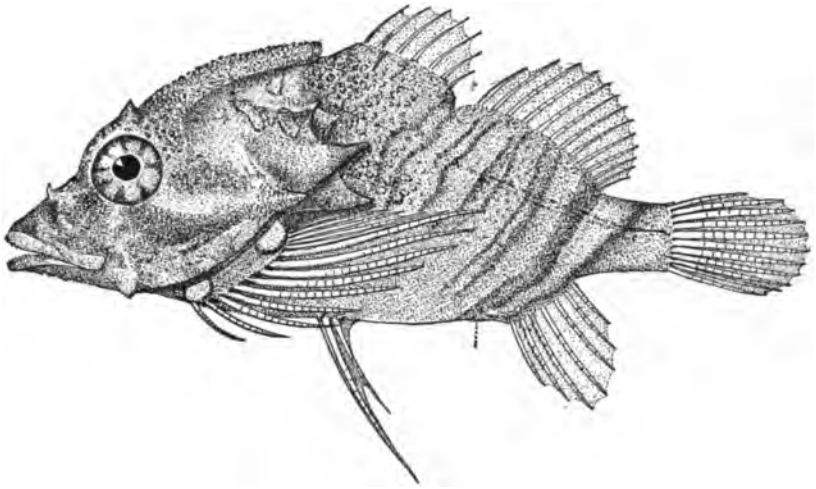


FIG. 90.—Rhamphocottus richardsoni Günther.

Family 35. AGONIDÆ. The Sea-Poachers.

168. **Hypsagonus quadricornis** (Cuvier & Valenciennes).

Specimens from 1.5 to 2 inches long were taken in 1903 at the following Albatross stations: 4204, 4205–7, 4212, 4268, 4284, one specimen being taken at each station. The species was also seen at Fort Rupert and Admiralty Inlet.

Recorded by Gilbert (1895) from north and south of the Aleutian Islands and in Bristol Bay at stations 3213, 3214, 3217, 3220, 3223, 3224, 3262, and 3322.

169. **Occa dodecaedron** (Tilesius).

Recorded by Nelson (1887) from Unalaklik and by Gilbert (1895), as *Brachyopsis dodecaedrus*, from Bristol Bay at stations 3239, 3240, 3242, and 3243.

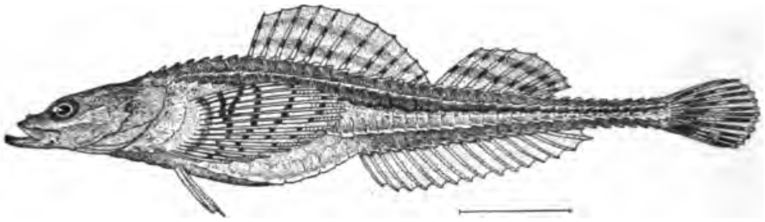


FIG. 91.—Occa dodecaedron (Tilesius).

170. **Pallasina barbata** (Steindachner).

Twelve specimens, 2.25 to 4 inches long, seined in Funter Bay; one, 4.75 inches long, seined in Kilisut Harbor; two, 3.8 and 5 inches long, seined in Cleveland Passage; all collected by the *Albatross* in 1903.

These specimens might just as well be called *P. aix*, except for the 3 or more rows of plates (sometimes 2) on median line in front of ventrals. *P. aix* is said to have but 2 and the neighboring plates small. These specimens have 2 or 3, and the other plates small or large. The barbel is short, in *barbata* it should be long.

Recorded as *Siphagonus barbata* (Bean 1882) from Port Mulgrave, Yakutat Bay; Unalaska; Port Clarence. Albatross stations 3239, 3240, 3242 to 3245, and 3258, all in Bristol Bay (Gilbert 1893). Iliuliuk, Unalaska (Turner 1886). Port Clarence (Scofield 1897).

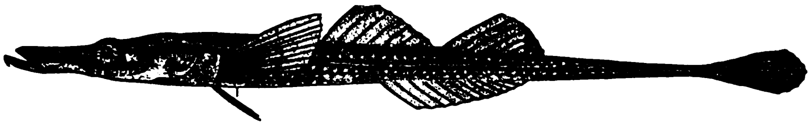


FIG. 92.—Pallasina barbata (Steindachner).

171. **Pallasina aix** Starks.

Recorded from Chignik Bay (Scofield 1899).

172. **Podothecus acipenserinus** (Tilesius).

Thirteen specimens, 2 to 5.5 inches, no label, but probably from Alaska; ten, 3 to 8.5 inches long, collected by the *Albatross* at stations 3598, 3600, and at Port Ludlow; twenty-five, 4.5 to 8 inches long, collected by the *Albatross* in 1903 at stations 4270 to 4272, 4276, and 4296; also at Marrowstone Point, and seined at Quarantine Station; one specimen taken at Yes Bay by the *Albatross* in 1905.

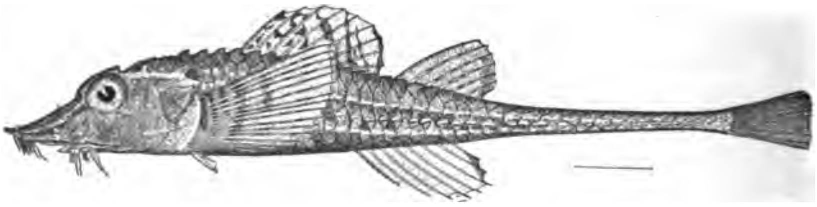


FIG. 93.—Podothecus acipenserinus (Tilesius).

In most of the specimens the plates on caudal peduncle have spines, which is contrary to current descriptions. The color also is different in our specimens; in most of them the black streaks between plates are absent; the 3 black bars on caudal peduncle and the one under anterior part of soft dorsal are not noted in current descriptions.

Originally described by Tilesius from Unalaska. Recorded by Bean (1882) from St. Paul, Kodiak Island; Unalaska; Cape Lisburne; Arctic Ocean. From many stations (44) around the Aleutian Islands and in Bristol Bay by Gilbert (1895). From St. Paul Island by Townsend (1887).

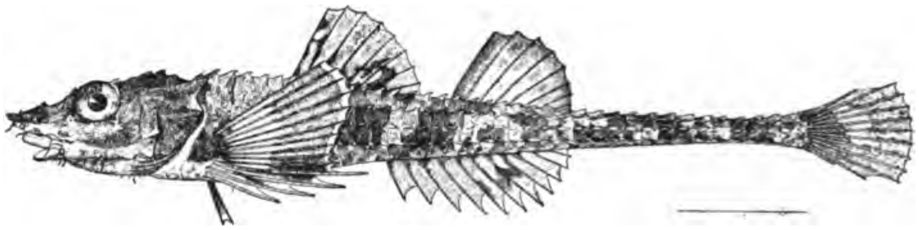


FIG. 94.—Averruncus emmelane Jordan & Starks.

173. **Averruncus emmelane** Jordan & Starks.

One specimen, 6.25 inches long, dredged at station 4222, mouth of Hood Canal. Only 2 other specimens known. They were taken in a seine near Port Orchard, Puget Sound, by E. C. Starks.

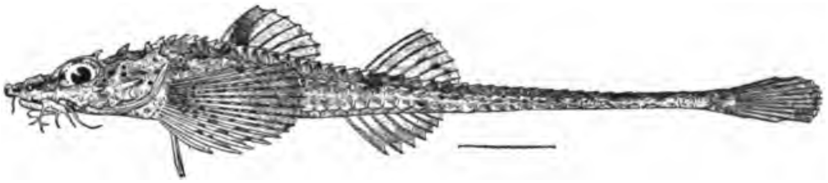


FIG. 95.—Sarritor frenatus Gilbert.

174. **Sarritor frenatus** Gilbert.

Six specimens, 2.5 to 10.5 inches long, collected by the *Albatross* at stations 3598, 3599, 4290, and 4292. Originally described by Gilbert (1895) as *Odontopyxis frenatus* from Albatross stations 3219, 3225 to 3227, 3255 to 3258, 3263, 3269, 3279, 3282, 3309, 3311, 3313, and 3330, located on both sides of the Alaskan Peninsula and both north and south of the Aleutian Chain.

175. **Sarritor leptorhynchus** (Gilbert).

Seven specimens, 3.25 to 4.5 inches long, were dredged at stations 4268, 4279, 4283, 4285, and 4286. Originally described by Gilbert (1895) from north and south of the Alaskan Peninsula at stations 3215, 3219, 3222, 3229, 3259, 3265, and 3267.

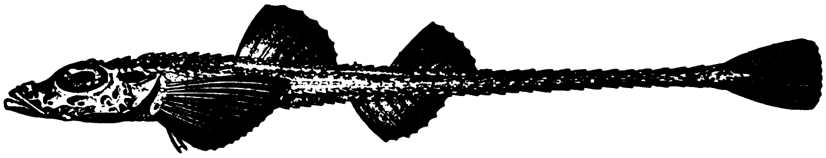


FIG. 96.—Bathyagonus nigripinnis Gilbert.

176. **Bathyagonus nigripinnis** Gilbert.

The collection contains 36 specimens, 2.25 to 8 inches long, dredged by the *Albatross* in 1903 at stations 4191, 4198, 4231, 4235, 4236, 4238, 4240, 4241, 4250 to 4252, 4258, and 4266. The species was originally described by Gilbert (1895) from north and south of Unalaska at stations 3210, 3316, 3324, 3325, 3329 to 3332, and 3337.

177. **Xenochirus pentacanthus** Gilbert.

This species is very generally distributed from Puget Sound to Bering Sea. It was never taken abundantly, but was found at a great many different places, 71 specimens, from 1.6 to 4.65 inches long, being taken at stations 3547 (Bering Sea), 3597, 4193, 4221, 4223, 4226, 4227, 4238, 4244, 4271, 4274 to 4276, 4278 to 4281, 4283, 4285 to 4289, 4290 to 4293, and 4295.

It is very doubtful whether the prickly breast (*alascanus*) and narrow interorbital (*pentacanthus*) which separate *pentacanthus* and *alascanus* are good characters. In this large series some have the prickly breast but narrow interorbital. With a larger series these 2 species would very probably run together.

178. **Xenochirus alascanus** Gilbert.

This species was not taken by us. It was originally described by Gilbert (1895) from vicinity of Unimak Pass at stations 3216, 3219, 3223, 3225 to 3226, 3257, 3258, 3263, 3309 to 3311, 3313, 3322, 3334, 3336, and 3339. Recorded from Karluk (Jordan & Gilbert 1899).

179. **Xenochirus latifrons** Gilbert.

We have 142 specimens, 3.5 to 6 inches long, collected by J. P. Todd near Seattle, 1903.

180. **Odontopyxis trispinosus** Lockington.

One specimen, 2.65 inches long, dredged at station 4221; one specimen, 2.4 inches long, dredged at station 4193; the species also seen at station 4226, near Loring, and station 4243, Kasaan Bay. Recorded from Sitka by Bean (1882) as *Podothecus trispinosus*.

181. **Aspidophoroides guntheri** Bean.

Originally described by Bean (1886) "from Alaska," in Bering Sea, perhaps. Not found by recent collectors.

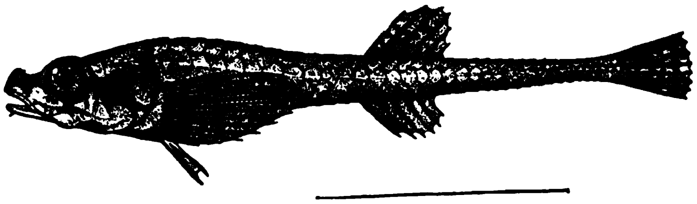


FIG. 97.—Aspidophoroides guntheri Bean.

182. **Aspidophoroides bartoni** Gilbert.

Eleven specimens, 2 to 5.25 inches long, were dredged at stations 3599 (Bering Sea), 4273, 4276, 4279, 4283, 4285, 4286, 4289, 4291, and 4292. This species was originally described by Gilbert (1895) from north and south of the Aleutian Islands and in Bristol Bay from 41 different dredging stations, ranging between 3213 and 3311.

183. **Aspidophoroides inermis** Günther.

One specimen, 2.75 inches long, dredged at station 4272; one specimen, 4 inches, mouth Hood Canal, collected by the *Albatross*, 1903. The type of this species came from Unalaska. The species was also taken at Albatross stations 3213, 3219, 3220, 3265, and 3322, these in Bristol Bay and north and south of the Aleutian group.

Family 36. CYCLOPTERIDÆ. The Lump Suckers.

184. **Eumicrotremus orbis** (Günther).

One specimen 1.1 inches long, mouth of Hood Canal, July 1; one specimen 1 inch long dredged at station 4205; one specimen 1.5 inches long dredged at station 4291; one specimen 3.85 inches long, taken from stomach of cod caught in Bering Sea in spring of 1902 in 500 feet of water. The species has also been recorded from Iliuliuk, Unalaska, and from St. Paul Island (Bean 1882) as *Eumicrotremus spinosus*. South of Sannak Islands and in Bristol Bay from stations 3213, 3258, and 3274 (Gilbert 1895). Off St. Paul Island (Jordan & Gilbert 1899).

185. **Lethrotremus muticus** Gilbert.

This species, not taken by recent collectors, was described by Gilbert (1895) from stations 3223 and 3258, near Unimak Pass.

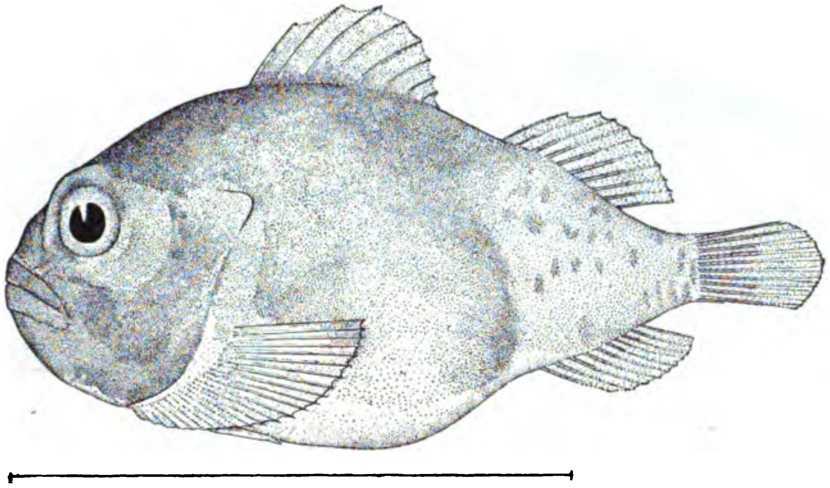


FIG. 98.—Lethrotremus muticus Gilbert.

186. **Cyclopteroides gyrinops** Garman.

Recorded from St. Paul Island (Garman 1892) and Dutch Harbor (Jordan & Gilbert 1899).

187. **Cyclopterichthys ventricosus** (Pallas).

No. 02234 and 02298, 8.5 and 7.75 inches long, respectively, collected by Rutter at Karluk in 1903. These 2 specimens show the two different schemes of coloration noted in descriptions. Recorded from St. Paul Island (Kincaid 1899).

Family 37. LIPARIDIDÆ. The Sea Snail.

188. **Neoliparis rutteri** Gilbert & Snyder.

Head 4 in length; depth 4.33; eye 4.6 in head; snout 3; interorbital equal to snout; dorsal v, 28; anal 26; pectoral 33; caudal 14; branchiostegals 6.

Body tadpole-shaped, anterior portion to origin of anal rounded, the remainder greatly compressed; dorsal outline gently arched; ventral outline of 2 gentle arches meeting each other at a broad angle at the origin of anal; head small, depressed; snout broadly rounded viewed from above, truncate from the side; mouth narrow, horizontal, with little lateral cleft and mandible barely included; lips rather thin; teeth small, white, tricuspid, in several rows in each jaw; nostrils inconspicuous, anterior with a small tube; several mucous pores on head along ramus of lower jaw and behind eye; gill-slit narrow, slightly wider than eye, entirely above upper base of pectoral; opercle ending in a soft sharp flap.

Dorsal fin low, its origin over middle of pectoral, its length about 3.5 times head, the fin quite low, the posterior rays longer, margin minutely crenulate, longest ray about 2.5 in head; anal similar to dorsal, its origin under about the third or fourth dorsal ray, last ray of anal slightly posterior to last dorsal ray and both fins slightly united to caudal at the tips of their last rays; caudal truncate, long and slender, its length about 1.2 in head; pectorals broad, of 2 lobes, the upper broad and rounded, lower narrow, its margin ill defined, and not very distinct from upper lobe; rays somewhat produced, longest ray considerably shorter than upper lobe, length of upper lobe 1.3 in head, tip reaching vent; ventral disk nearly circular, its length 1.6 in head, 13 horny lobes, rather deciduous.

Color jet black above, lighter on belly, a white crescent-shaped line across base of caudal, extending on tip of last dorsal and anal ray; caudal indistinctly barred with black and white bars; dorsal and anal fins dark, edges with a narrow black border.

We have 13 specimens, varying from 0.75 to 2.75 inches long, collected by Mr. Rutter at Karluk, June 8–10, 1903. The species is recorded by Rutter (1899) from Karluk and Uyak Bay.

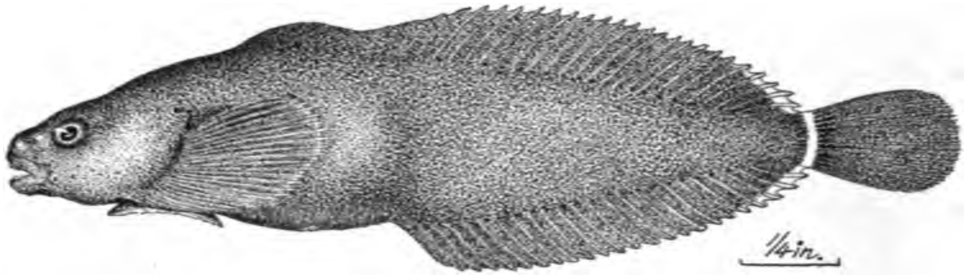


FIG. 99.—Neoliparis rutteri Gilbert & Snyder.

189. Neoliparis callyodon (Pallas).

One hundred and twenty-six specimens, 0.75 to 5 inches long, secured in 1903 from the following places: Shakan Bay; Diamond Point; Point Ellis; Funter Bay; stations 4205–7; Naha Bay, Loring; Neah Bay, and at Karluk.

Recorded (Bean 1882, as *Liparis calliodon*) from Port Etches; Belkofski; Sanborn Harbor, Shumagins; Nateekin Bay, Unalaska; Adak; Amchitka; St. Michael. Unalaska (Gilbert 1895). Karluk and Uyak Bay (Rutter 1899). St. Michael (Turner 1886, as *Liparis calliodon*). Jordan & Gilbert (1899) found it at Captains Harbor, Unalaska; St. Paul Island; St. George Island, and Sitka.

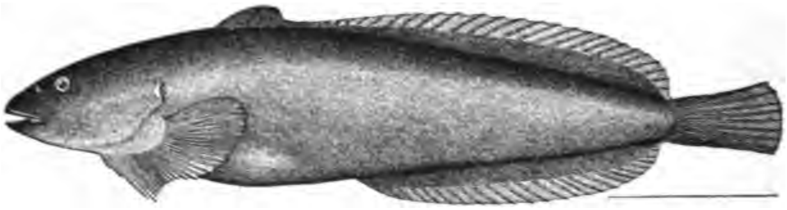


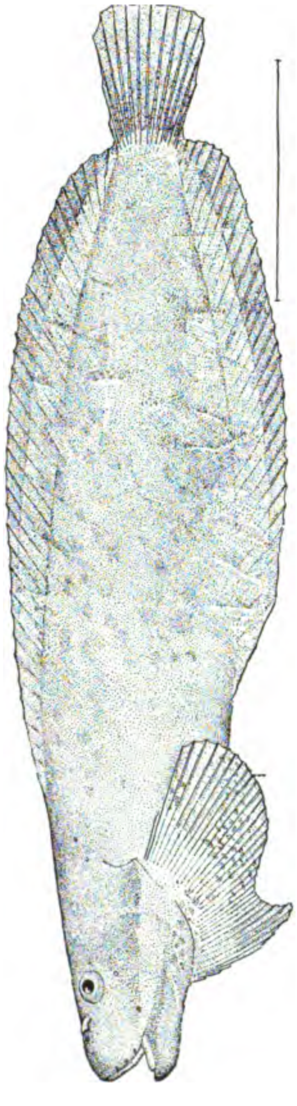
FIG. 100.—Neoliparis callyodon (Pallas).

190. Liparis cyclopus Günther. (Pl. XVIII, fig. 1.)

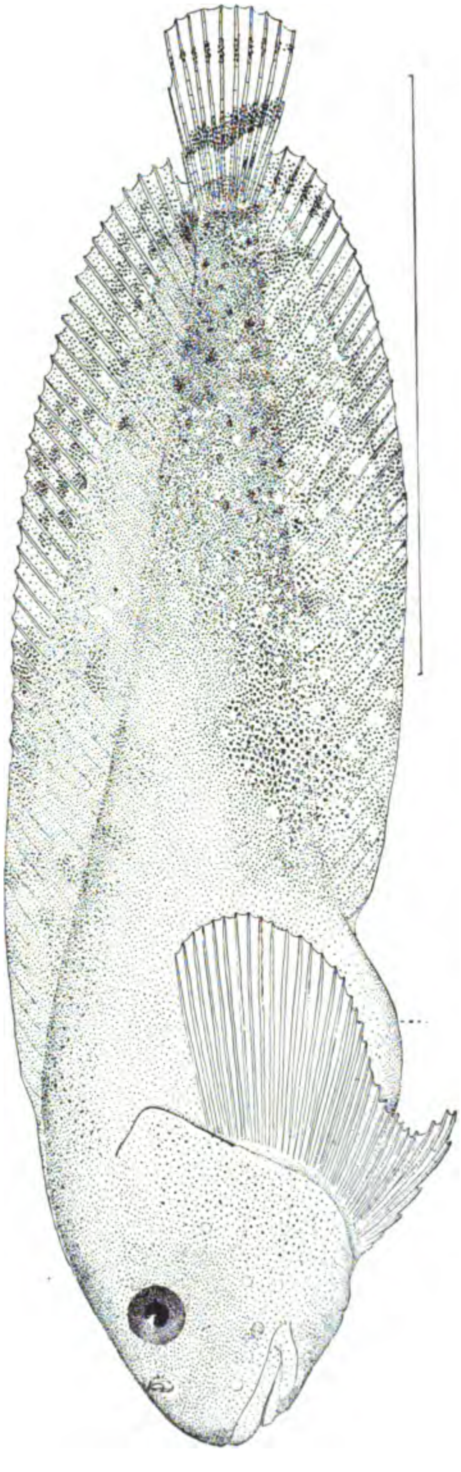
Recorded from Unalaska (Bean 1882) as *Liparis cyclopus;* Atka Island (Turner 1886) as *Liparis cyclopus;* Bristol Bay, at station 3230 (Gilbert 1895).

191. Liparis fucensis Gilbert.

Twelve specimens, 1.4 to 3.25 inches long, dredged at stations 4208, 4220, 4270 to 4272, 4289, and 4302, and mouth Hood Canal; and 22 (small) from station 4256.

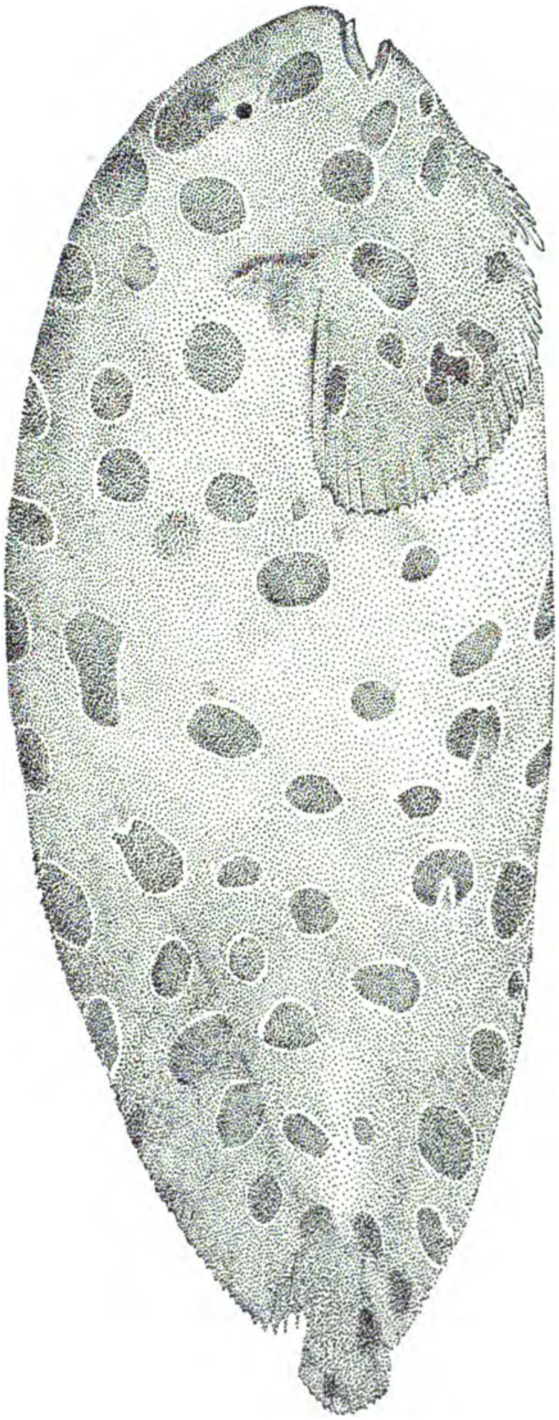


1. LIPARIS CYCLOPUS GÜNTHER.



2. LIPARIS HERSCHELINUS SCOFIELD.

UNIV. OF MICH.



LIPARIS CYCLOSTIGMA GILBERT.

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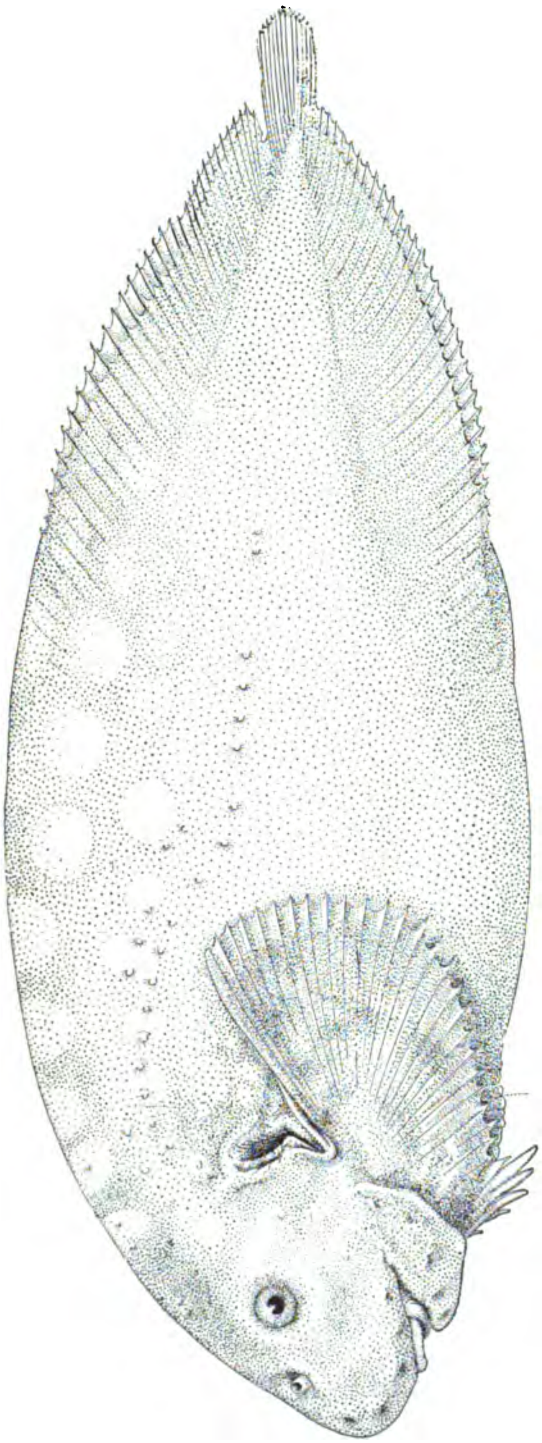
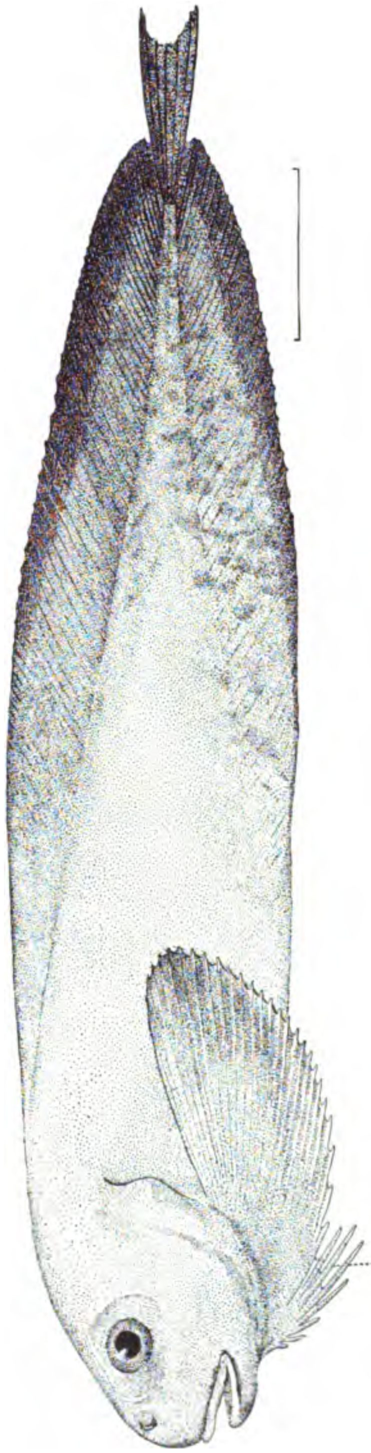


1. CRYSTALLICHTHYS MIRABILIS JORDAN & GILBERT.



2. PROGNURUS CYPSELURUS JORDAN & GILBERT. TYPE.

UNIV. OF MICH.

192. **Liparis agassizii** Putnam.

Recorded from Unalaska and St. Paul Island (Bean 1882) as *Liparis gibbus*. Bristol Bay at stations 3241, 3247, and 3305 (Gilbert 1895). Point Barrow (Murdoch 1885).

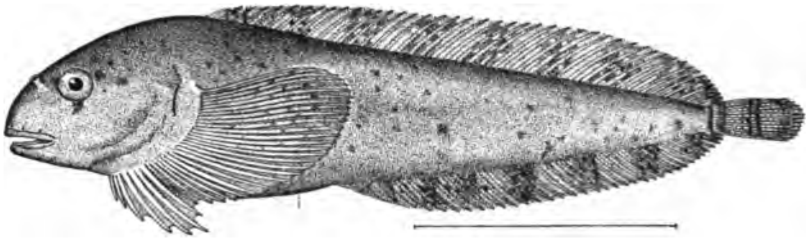


FIG. 101.—Liparis agassizii Putnam.

193. **Liparis herschelinus** Scofield. (Pl. XVIII, fig. 2.)

Recorded from Herschel Island, Arctic Ocean (Scofield 1899).

194. **Liparis cyclostigma** Gilbert. (Pl. XIX.)

Originally described by Gilbert (1895) from Bristol Bay at station 3252, near Unalaska.

195. **Liparis pulchellus** Ayres.

Recorded from St. Paul, Kodiak Island, and from Iliuliuk, Unalaska (Bean 1882); Tongass (Bean 1884); station 3269 in Bristol Bay (Gilbert 1895).

196. **Crystallichthys mirabilis** Jordan & Gilbert. (Pl. XX, fig. 1.)

Recorded from station 3638, off St. Paul Island (Jordan & Gilbert 1899).

197. **Careproctus simus** Gilbert.

Originally described by Gilbert (1895) from north of Unalaska at station 3331.

198. **Careproctus colletti** Gilbert.

One specimen, 3.5 inches long, from station 4295, Shelikof Straits.

This specimen differs somewhat from current descriptions; the head is 4, not 6; distance from tip of snout to origin of anal is 2.5, not 3.66. Color almost white, not dusky, though our specimen may have faded. Mouth and gill cavity not dusky; peritoneum white, not dusky.

This species was originally described by Gilbert (1895) from station 3338, south of Alaskan Peninsula.

199. **Careproctus phasma** Gilbert.

Originally described by Gilbert (1895) from Bristol Bay at stations 3254 and 3256.

200. **Careproctus spectrum** Bean.

Originally described by Bean (1891) from Albatross station 2848, between Unga and Nagai islands.

201. **Careproctus ostentum** Gilbert.

Originally described by Gilbert (1895) from north of Unalaska Island at stations 3324 and 3331.

202. **Careproctus ectenes** Gilbert.

Originally described by Gilbert (1895) from north of Unalaska at station 3331.

203. **Prognurus cypselurus** Jordan & Gilbert. (Pl. XX, fig. 2.)

Originally described by Jordan & Gilbert (1899) from Albatross station 3644, off Bogoslof Island.

204. **Gyrinichthys minytremus** Gilbert.

Originally described by Gilbert (1895) from north of Unalaska Island at station 3331.

205. **Paraliparis holomelas** Gilbert.

Originally described by Gilbert (1895) from north of Unalaska at stations 3308 and 3332. We have 25 specimens taken at stations 4194, 4202, 4251–4253, 4255, 4258, 4292 and 4293.

206. **Paraliparis cephalus** Gilbert.

Recorded by Gilbert (1895) from north of Unalaska at stations 3225 and 3330.

207. **Paraliparis ulochir** Gilbert.

Originally described by Gilbert (1895) from north of Unalaska at station 3332.

208. **Rhinoliparis barbulifer** Gilbert.

Originally described by Gilbert (1895) from north of Unalaska at stations 3227, 3325, 3326, 3329 to 3332.

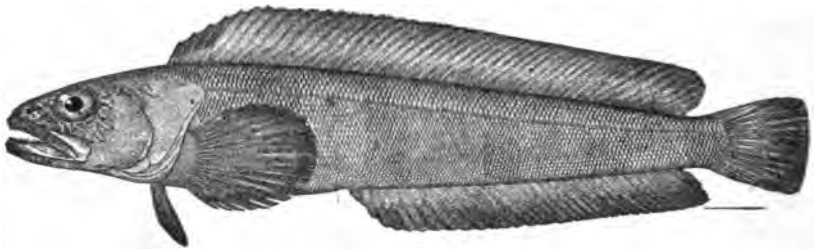


FIG. 102.—Bathymaster signatus Cope.

Family 38. BATHYMASTERIDÆ.

209. **Bathymaster signatus** Cope.

Seventeen specimens 1.5 to 11.75 inches long, collected at stations 3856, 3599 (Bering Sea), 4285, 4289, and at Karluk; Loring; Yes Bay; Redfish Bay; Killisnoo; Sitka; and Pablof Harbor.

It has been recorded (Bean 1882 and 1884) from Sitka; St. Paul, Kodiak Island; Coal Harbor and off Popoff Island, Shumagins; Iliuliuk, Unalaska; Mary Island; Fort Wrangell; Port Chester and Nakat. Gilbert (1895) records it as very abundant in the shallow water dredgings along the southern shore of the Alaskan Peninsula, northward through Unimak Pass and north of Unalaska at stations 3211 to 3215, 3217, 3220, 3222, 3223 and 3319, and Jordan & Gilbert (1899) record it from Sitka.

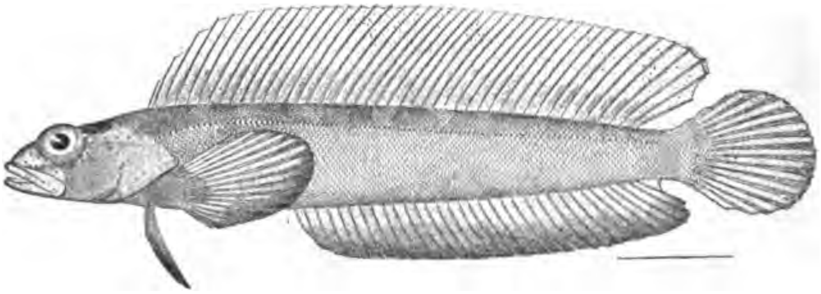


FIG. 103.—Ronquilus jordani Gilbert.

210. **Ronquilus jordani** Gilbert.

The collection contains 37 specimens 2.5 to 6.75 inches long taken in Admiralty Inlet, at Hood Canal, and at stations 4193, 4197, 4204, 4209, 4212, 4213, 4220, 4228, 4272, 4278 and 4289. The species was originally described by Gilbert (1889) as *Bathymaster jordani* from Fort Wrangell. He also records it under the same name from station 3262 in Bristol Bay.

Family 39. TRICHODONTIDÆ.

211. **Trichodon trichodon** (Tilesius).

We have 1 specimen 2.5 inches long collected by the *Albatross* in Akutan Bay, September 17, 1894.

The species has been recorded (Bean 1882) as *Trichodon stelleri* from Coal Harbor and Humboldt Harbor, Shumagins; Unalaska, and Cape Etolin, Nunivak Island. Bristol Bay at station 3260 and from Herendeen Bay (Gilbert 1895). Mr. H. C. Fassett examined a specimen at Klawak in 1905 which was taken near that place.

Though rare, this curious fish appears to be widely distributed in Alaska.

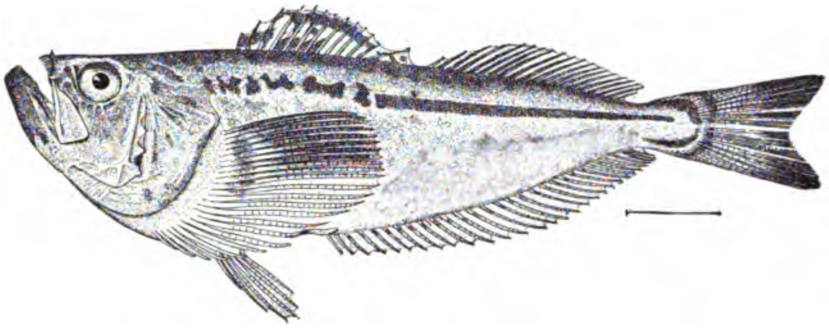


FIG. 104.—Trichodon trichodon (Tilesius).

212. **Arctoscopus japonicus** (Steindachner).

We have 1 specimen 1 inch long collected by the *Albatross* in Akutan Bay, July 24, 1894.

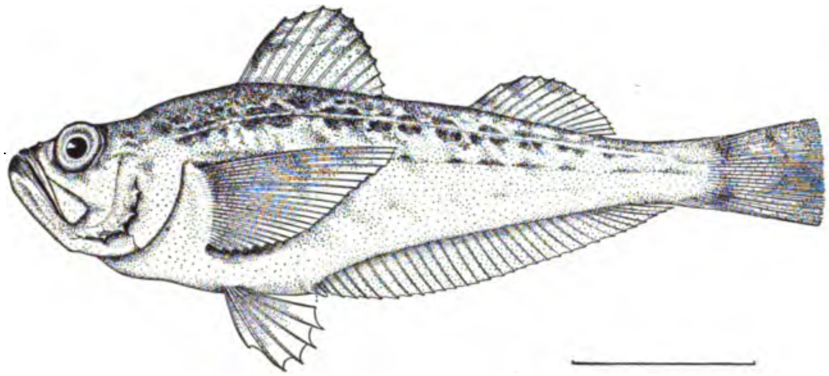


FIG. 105.—Arctoscopus japonicus (Steindachner).

Family 40. BATRACHOIDIDÆ. The Toadfishes.

213. **Porichthys notatus** Girard.

The collection contains 6 specimens 5 to 6.75 inches long, collected at Union Bay and at station 4218.

Family 41. GOBIESOCIDÆ. The Clingfishes.

214. **Caularchus mæandricus** (Girard).

The collection contains 2 specimens, each 2.75 inches long, seined at Fort Rupert June 28, 1903. We also have 2 specimens 1.5 and 2.25 inches long taken at Gabriola Island by the *Albatross*.

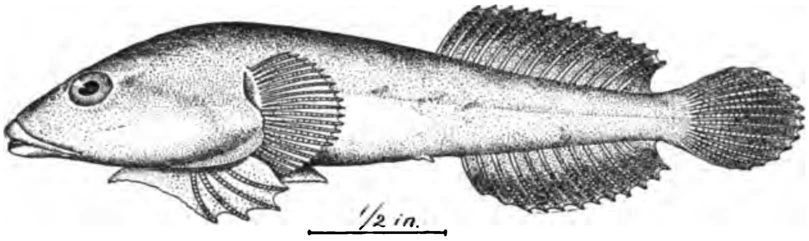


FIG. 106.—Caularchus mæandricus (Girard).

Family 42. BLENNIIDÆ. The Blennies.

215. **Bryostemma polyactocephalus** (Pallas).

One specimen 7 inches long seined at station 4228; 2 specimens 4.5 inches long dredged at station 4205; no. 2914, a specimen 11.4 inches long, from station 4253.

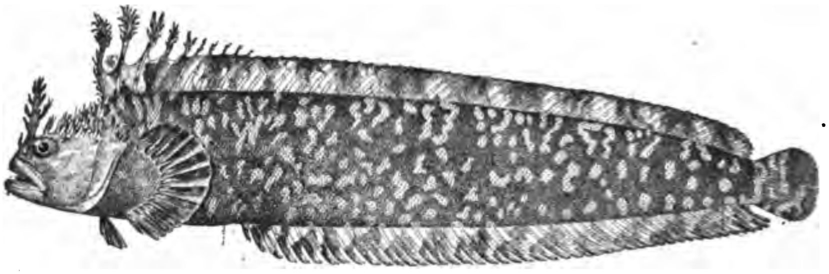


FIG. 107.—Bryostemma polyactocephalus (Pallas).

In the smaller examples the cirri on the top of head are coarse, thick, and blunt; in the larger examples they are quite different, being small and hairlike and not so numerous.

Recorded from stations 3213 and 3274, north and south of the Alaskan Peninsula (Gilbert 1895) as *Chirolophus polyactocephalus*. St. Michael (Nelson 1887) and St. Paul (Jordan & Gilbert 1899).

FIG. 108.—Apodichthys flavidus Girard.

216. **Apodichthys flavidus** Girard.

The collection contains 22 specimens 4 to 8 inches long from Sucia Island, May 6, 1894.

217. **Pholis dolichogaster** (Pallas).

Recorded from Kigiktowik and Unalakleet, Norton Sound (Nelson 1887) as *Muraenoides ruberrimus*, and from Aleutian Islands (Bean 1882) as *Muraenoides dolichogaster*.

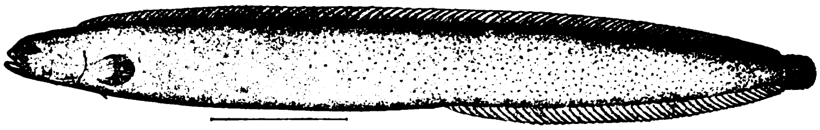


FIG. 109.—Pholis dolichogaster (Pallas).

218. **Pholis fasciatus** (Bloch & Schneider).

We have 14 specimens 2.25 to 3 inches long, collected by Rutter at Karluk June 8–10, 1903, and one specimen 7 inches long collected by Mr. M. C. Marsh at St. Paul Island, Pribilof Group, 1906. The species has been recorded from St. Paul Island (Bean 1882) as *Muræenoides maxillaris* and from Bristol Bay at stations 3230, 3232 to 3234 (Gilbert 1895).

219. **Pholis gilli** Evermann & Goldsborough, new species.

Head 8.66 in length; depth at origin of dorsal 10.5; eye 5 in head; snout 5; maxillary 3.25; mandible 2.5; interorbital 1.5 in eye; dorsal LXXXIV; anal II, 44;. pectorals 15; branchiostegals 4.

Body elongate, greatly compressed, almost ribbon-shaped; head small, upper profile arched, anterior profile rounded; a high sharp ridge from nape to snout; snout blunt, short; mouth small, very oblique; jaws nearly equal; maxillary reaching anterior edge of orbit; teeth conical, stout, in a single row in the jaws, except for a patch on anterior edge of lower jaw, none on vomer and palatines; upper lip a high, thin fold continuous posteriorly with the fold on lower lip, latter interrupted by a broad frenum; nostrils close behind upper lip, posterior in a small tube; a row of conspicuous tubes below eye running backward and upward posteriorly; gill-opening free from isthmus, forming a broad fold, not continued forward; eye small, anterior, high.

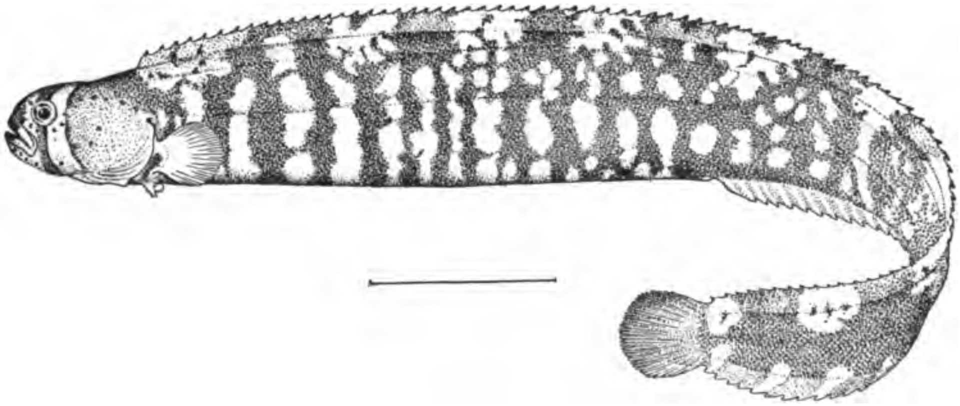


FIG. 110.—Pholis gilli Evermann & Goldsborough, new species. Type.

Origin of dorsal above base of pectoral, its anterior spines concealed in membrane, short, gradually lengthening posteriorly, the spines not concealed, the longest spine slightly longer than eye; dorsal and anal connected for their entire height, forming a slight notch with the broad rounded caudal, the length of caudal about half head; anal low, with 2 short stout spines, membranes thick, nearly concealing the rays; vent midway between root of pectoral and base of caudal; pectoral short and broadly rounded, 2.5 in head; ventral very minute, its rays about equal to spine, which equals pupil. Scales minute, covering body, head naked.

Color in alcohol: General color brown, the minute scales giving this brown the appearance of small white punctulations; a series of 10 white blotches punctate with brown along base of dorsal, each one extending from upper edge of fin down upon body, forming semicircular patches about as large as pectoral fin; a series of irregular white parallel bars about as wide as eye on anterior lower half of side, these broken posteriorly into rows of dots; head pale beneath, a white stripe extending from front of occiput through eye to posterior tip of mandible, broadening somewhat as it descends, another small white stripe extending vertically along anterior margin of orbit; snout and lower lip brown, chin white; caudal and anal dusky; ventral and pectoral plain; dorsal general color of back.

This fish differs from the description of *P. dolichogaster* in having the anterior spines of dorsal short, also in having a sharp ridge on interorbital space, and the color entirely different.

The above from the type, no. 57826, U. S. National Museum, a specimen 6.75 inches long collected in Bering Sea in 1902, sent in by Mrs. E. W. Clark, of Washington, D. C.

Named for Dr. Theodore Nicholas Gill.

220. **Pholis ornatus** (Girard).

The collection contains 208 specimens 1.6 to 8 inches long. It is common along the shores from Port Townsend to Unalaska and was collected at the following places: Marrowstone Point; Admiralty Head; Port Townsend; Fort Rupert; Union Bay; Whidby Island; Kilisut Harbor; Duncan Canal; Sucia Island; Tongass Harbor; Metlakahtla; Loring; Yes Bay; Karta; Klawak; Shakan; Funter Bay; Ankau River; Karluk; Litnik; and Unalaska.

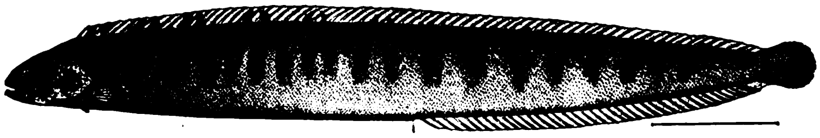


FIG. 111.—Pholis ornatus (Girard).

There are 2 very distinct color patterns in our specimens. Most of them have the ocellate spots on the dorsal and upper part of body; others have broad U-shaped dark marks on dorsal and upper part of body instead of these dark spots. The latter have from 1 to 3 dark spots on anterior rays of dorsal, these sometimes indistinct.

This species has been recorded as *Muraenoides ornatus* (Bean 1882) from Sitka; Port Mulgrave, Yakutat Bay; Port Etches; Chugachik Bay and Refuge Cove, Cook Inlet; Kodiak; Coal Harbor and Sanborn Harbor, Shumagins; Belkofski, Alaska Peninsula; Iliuliuk, Unalaska; Atka; Adak; Amchitka; Attu and Port Moller, and under the same name by Bean in 1884 from Wrangell and Tongass. Unalaska and Herendeen Bay (Gilbert 1895). Karluk and Uyak and Alitak bays (Rutter 1899). Atka Island (Turner 1886) as *Muraenoides ornatus.*

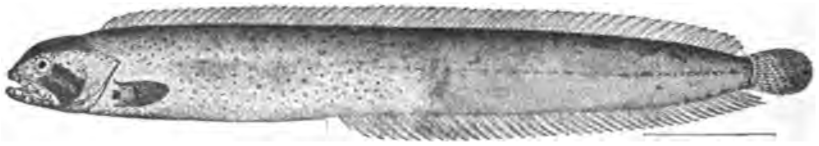


FIG. 112.—Anoplarchus atropurpureus (Kittlitz).

221. **Anoplarchus atropurpureus** (Kittlitz).

This collection contains 204 specimens one-half to 4.5 inches long. The species is common along the shore from Port Townsend to Bering Sea. It was taken at the following places: Gabriola Island, Point Ellis, Fort Rupert, Port McArthur, Loring, Shakan Bay, Klawak, Alitak Narrows, Karluk, Uyak Bay, and Atka Island.

It has been recorded from St. Michael by Nelson (1887). By Bean (1882) from Sitka; Port Mulgrave; Kodiak Island; Coal Harbor, Sanborn Harbor, and Popoff Straits, Shumagins; Unalaska;

Nazan Bay, Atka; Amchitka; Kyska Harbor; Port Etches; St. Michael. Wrangell, Mary Island, and Tongass (Bean 1884). Unalaska (Gilbert 1895). Rutter (1899) found it common at Karluk, and in Uyak, and Alitak bays.

222. **Xiphistes chirus** (Jordan & Gilbert).

Recorded by Bean (1882) from Adak and Amchitka, Aleutian Islands.

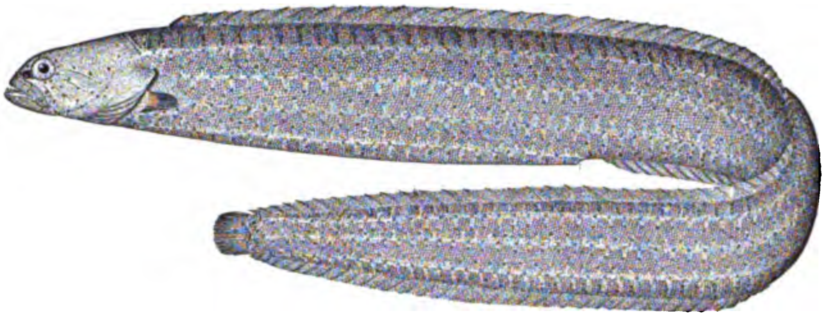


FIG. 113.—Xiphistes chirus (Jordan & Gilbert).

223. **Xiphidion mucosum** Girard.

The collection contains 14 specimens, 1.5 to 6.75 inches long, collected at Gabriola Island, Point Ellis, and Port Rupert. The species has been recorded from Wrangell and Mary Island by Bean (1882) as *Xiphistes mucosus.*

224. **Xiphidion rupestre** (Jordan & Gilbert).

We have 1 specimen 5 inches long from Cedar Island, Loring, June 17, 1904. Bean (1882) records it from Sitka as *Xiphister rupestris.*

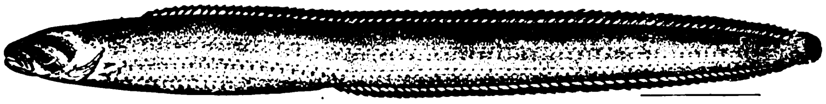


FIG. 114.—Xiphidion rupestre (Jordan & Gilbert). Type.

225. **Opisthocentrus ocellatus** (Tilesius).

We have 8 specimens, 5.5 to 7 inches long, collected at Tareinski Harbor, Kamchatka, 1900, by the *Albatross.*

226. **Leptoclinus maculatus** (Fries).

The collection contains 3 specimens 4 to 5.5 inches long from Albatross stations 4274 and 4279. Recorded from station 3223 in Unimak Pass and stations 3252, 3253, 3257 to 3259, 3279 and 3309, all in Bristol Bay (Gilbert 1895).

227. **Poroclinus rothrocki** Bean.

Originally described by Bean (1891) from Albatross station 2852, between Nagai and Big Koniushi Island. Station 3312, north of Unalaska Island (Gilbert 1895).

228. **Lumpenus medius** (Reinhardt). (Pl. XXI, fig. 1.)

Head 5 in length; depth 8.9; eye 3.5 in head; snout 4.6; interorbital 3 in eye; dorsal LVIII; anal II, 35 (35 to 38); pectoral 14; ventral 3; caudal 2.2 in head; ventral 2.75; pectoral 1.35.

The collection contains 21 specimens, 2.5 to 11 inches long, collected at stations 4243, 4270 to 4272, 4274 to 4276, 4280, 4281, 4287, and in Kasaan Bay.

229. **Lumpenus anguillaris** (Pallas).

This species was found to be quite common. It was taken at various points and seen at many others from Seattle to Atka Island. One hundred and fifty-two specimens, ranging from 1.75 to 14.5 inches in length, were secured from the following places: Seattle; Kilisut Harbor; Duncan Canal; Loring; Ankau River; New Morzhovoi; Pablof Harbor; Akutan Bay; Makushin Bay; Unalaska; Atka; and stations 4214, 4218, 4236, 4272, and 4296.

Recorded (Bean 1882) from Port Mulgrave, Yakutat Bay; Chugachik Bay, Cook Inlet; Port Levashef, Iliuliuk and Chernofski, Unalaska; Wrangell and Sitka, and, in cruise of the *Corwin*, from Point Belcher. Also from Norton Sound (Nelson 1887). Nakat Harbor and Boca de Quadra (Bean 1884). Unalaska (Gilbert 1895).

230. **Lumpenus mackayi** Gilbert.

Originally described by Gilbert (1895) from mouth of Nushagak River.

231. **Lumpenus fabricii** (Cuvier & Valenciennes).

Recorded from Bristol Bay at stations 3241 to 3244 (Gilbert 1895) as *Leptoblennius nubilus.*

232. **Lumpenus longirostris** Evermann & Goldsborough, new species.

Head 5.25 in length; depth 8.2; eye 4.75 in head; snout 2.8; dorsal LXIII (LXIII to LXXI); anal III (III to V), 39 (38 to 42); interorbital 1.2 in eye.

Body elongate, compressed; head long, compressed, interorbital slightly convex; eye large, elongate, median, high; snout long, blunt, and projecting, mouth small, nearly horizontal, lower jaw included; maxillary not nearly reaching eye, reaching halfway from tip of snout to posterior edge of eye; teeth in a single crowded row on each jaw, crowded and more or less in a patch anteriorly, no teeth on vomer or palatines; gill-openings continued forward to below anterior edge of pupil, the membranes then narrowly joined to isthmus.

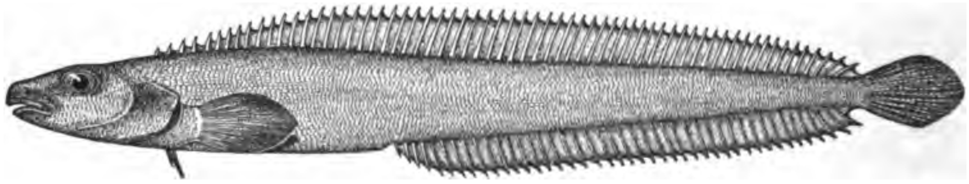


FIG. 115.—Lumpenus longirostris Evermann & Goldsborough, new species. Type.

Dorsal fin beginning immediately above upper end of gill-opening, the spines short, strong, and pungent, none of them flexible, the anterior ones very short, less than width of pupil, the fin gradually increasing in height to opposite front of anal, thence decreasing very slowly to posterior end, the longest spine about 1.3 in snout, the third ray from last two-thirds height of longest ray, the tips of the spines naked for about one-quarter of their height; anal with 3 (in most examples 4) strong spines similar to those of dorsal fin, the first half as high as second, which equals third, soft rays all forked and of about equal length, the last 3 free for upper third of their length; caudal rounded, 1.9 in head; ventral short, of 1 short sharp strong spine, equal to perpendicular diameter of eye, and 3 simple rays, the fin 2 in snout; pectoral large, rounded, the middle rays longest, 1.5 in head.

Scales small, smooth, rounded, covering entire body and head, those of head smaller and more closely imbricated.

The foregoing description from the type no. 57827 U. S. National Museum, a specimen 9.3 inches long, taken in Lynn Canal, July 16, 1903, at Albatross station 4255. The Bureau of Fisheries cotype is no. 5232; Stanford University Museum, no. 20013; Field Museum of Natural History, no. 6116; Academy of Natural Sciences, Philadelphia, no. 33005.

Life colors of one example: Back and upper side light olivaceous with darker brownish blotches; middle of side and underparts sooty blue; middle part of belly blackish; pectoral and ventral dark; dorsal pale yellowish at base, a narrow dark line near edge.[a]

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[a] Not necessarily color of type, it not being known from which specimen the note was taken.

Color in spirits, grayish olivaceous, edge of dorsal, anal, and of gill-opening black; pectoral, caudal, ventral, and lips black; a dark blotch on opercle; belly and top of head slightly darker than body.

MEASUREMENTS OF 19 EXAMPLES OF LUMPENUS LONGIROSTRIS FROM STATION 4254.

No.	Length.	Head.	Depth.	Eye.	Snout.	Dorsal.	Anal.
	Inches.						
52	6¼	5¾	9½	4½	2¾	LXV	IV, 40
53	8	5¼	9⅝	5	2¾	LXVI	IV, 40
54	7	5¼	9⅝	5	2¼	LXX	IV, 42
55	7	5⅛	9⅜	5	2¼	LXV	IV, 40
56	6⅞	5¾	9¾	5⅛	3	LXV	IV, 41
57	6⅝	5½	9⅜	5⅛	2¾	LXVI	IV, 41
58	8⅛	5¼	9⅝	5⅛	2⅝	LXIV	IV, 40
59	5⅝	5⅞	10	5	2¾	LXIV	V, 38
60	6⅝	5½	9¾	5⅛	2¾	LXIV	IV, 41
61	5⅜	5¾	9⅝	5	3	LXIV	IV, 39
62	4½	5¾	10¼	4½	3	LXIV	IV, 40
63	7¼	6⅛	9⅝	5	2⅝	LXVII	IV, 43
64	8⅛	6	8½	5¾	2¾	LXV	IV, 40
65	7¼	5⅞	9½	5¼	2¾	LXIV	IV, 41
66	7⅞	5⅝	9⅜	5	3⅛	LXIV	IV, 40
67	7	5½	8¾	5	2⅝	LXIV	IV, 40
68	6	5⅛	9⅓	5⅝	3	LXIV	IV, 41
69	7⅛	5⅝	9⅜	4½	3	LXV	IV, 39
70	6½	5¾	10	5¾	2⅝	LXVI	IV, 42

This species may be readily distinguished by its very long snout, in which respect it differs from all the other species of *Lumpenus*, and in the naked tips of the dorsal spine. We have 60 other specimens, ranging in length from 2.5 to 9.87 inches, all of which we take as cotypes. They were collected at stations 4238, 4251, 4252, 4254, 4255, and 4256.

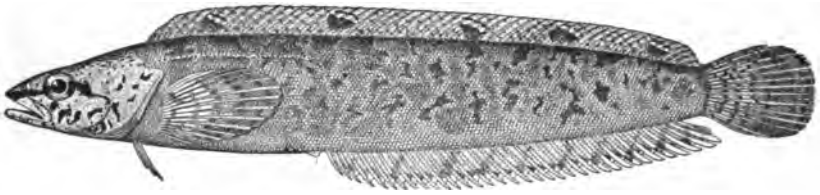


FIG. 116.—Stichæus punctatus (Fabricius).

233. **Stichæus punctatus** (Fabricius).

Recorded from St. Michael (Nelson 1887, Bean 1879). Cape Lisbourne (Bean 1882) as *Notogrammus rothrockii*. Bristol Bay at station 3239 and from Karta Bay (Gilbert 1895).

Family 43. CRYPTACANTHODIDÆ.

234. **Delolepis virgatus** Bean.

The collection contains a specimen (no. 1660), 40 inches long, collected at Dutch Harbor, 1893 or 1894. Species originally described by Bean (1882) from Kingcombe Inlet, British Columbia, and Port Wrangell; recorded also from Unalaska (Gilbert 1895).

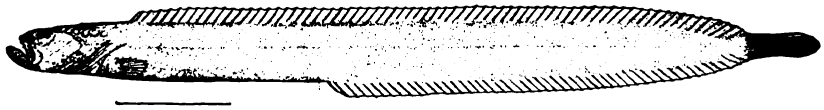


FIG. 117.—Lyconectes aleutensis Gilbert.

235. **Lyconectes aleutensis** Gilbert.

Originally described by Gilbert (1895) from station 3312, north of Unalaska.

Family 44. ANARHICHADIDÆ. The Wolf-Fishes.

236. **Anarhichas lepturus** (Bean).

Recorded from St. Michael and Kigiktowik (Nelson 1887); also from St. Michael (Turner 1886).

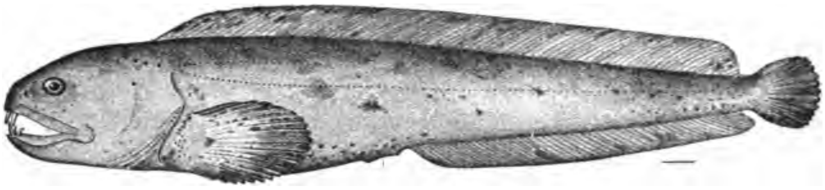


FIG. 118.—Anarhichas lepturus (Bean).

Family 45. PTILICHTHYIDÆ. The Quill-Fishes.

237. **Ptilichthys goodei** Bean.

One specimen, 13.5 inches long, from Snug Harbor, August 6, 1903, caught in dip net over rail of ship. Originally described by Bean (1882) from Port Levashef, Unalaska. Recorded by Gilbert (1895) from station 331, Unalaska Harbor.

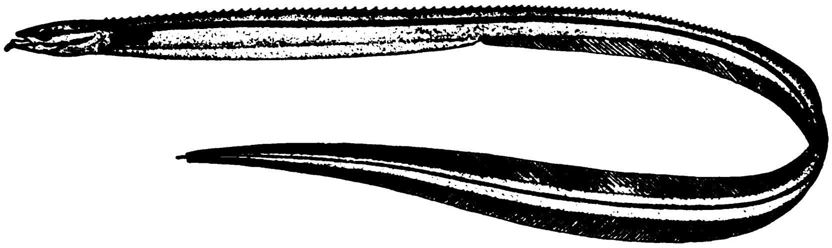


FIG. 119.—Ptilichthys goodei Bean.

Family 46. ZOARCIDÆ.

238. **Lyciscus crotalinus** (Gilbert).

Recorded by Gilbert (1895) as *Lycodopsis crotalinus* from station 3210, south of Sannak Island.

239. **Lycodopsis pacificus** (Collett).

This species, not heretofore recorded north of Puget Sound, was taken at station 4272, in Afognak Bay, and also at stations 4214, 4219, 4223, and 4233, and at Seattle. Twenty-three specimens, ranging from 3 to 8.75 inches in length, were collected. In some there is a very evident black blotch on the upper part of the 3 or 4 anterior dorsal rays.

240. **Lycodes concolor** Gill & Townsend.

Described from Bering Sea, latitude 55° 19′ north, longitude 168° 11′ west, at *Albatross* station 3608, in 276 fathoms.

241. **Lycodes digitatus** Gill & Townsend.

Described from Bering Sea, latitude 56° 14′ north, longitude 164° 8′ west, at Albatross station 3541, in 49 fathoms.

242. **Lycodes palearis** Gilbert.

The collection contains 7 specimens, 2.25 to 15.5 inches long, taken at stations 4223, 4246, 4272, and 4273.

The species was originally described from stations 3253 and 3254, Bristol Bay (Gilbert 1895).

243. **Lycodes jordani** Evermann & Goldsborough, new species.

Head 7 in total length; depth 14; eye 4.5 in head; snout 3.5; maxillary 2.9; interorbital 3 in length of eye; length of pectoral 2.1 in head; ventral 1.5 in eye; dorsal 116; anal 93 (dorsal and anal counts taken from cotype).

Head and nape naked, rest of body fully scaled, except the axil of pectoral, which is naked; dorsal origin over anterior part of pectoral; anal origin under about the eighteenth dorsal ray; pectorals nearly rounded in outline, the fourth to seventh rays from the upper part being the longest, all the rays except a few upper free at their tips, the free margin about equal in length to pupil.

Top of head flat, the interorbital space about equal to pupil, the bone being much narrower, about one-fourth the space; maxillary reaching anterior edge of pupil; small villiform teeth on vomer, palatines, and jaws, those on jaws in a single row laterally, broadening into a patch anteriorly; a row of 4 large pores on mandible, the row continued in 3 similar pores on preopercle; 6 similar but smaller pores extending from anterior nasal opening just above maxillary and posteriorly under eye, the last pore above the next to last in lower row; anterior nasal opening with short tube; lower jaw included; upper jaw reaching very slightly beyond lower, for a distance less than half width of pupil; lateral line not evident.

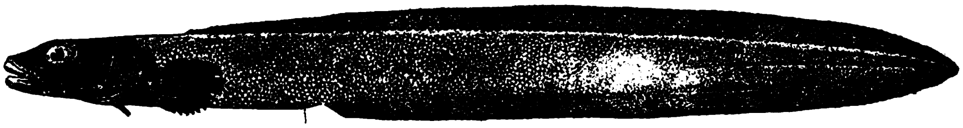


FIG. 120.—Lycodes jordani Evermann & Goldsborough, new species. Type.

General color: Brownish olivaceous, the scales on body and fins white, giving the body the appearance of being white spotted, the pectoral, head, and edges of dorsal and anal a darker olive than that of body.

Another specimen from station 4267, and which we take as a cotype, gives the following measurements: Head 6.8 in total length; depth 16.5; eye 4.66 in head; snout 3.9; interorbital 1.3 in eye, the bone about 4 in eye; maxillary 3 in head; mandible 3.4; ventral equaling eye; pectoral 2 in head; dorsal 116; anal 93.

This species is near *Lycodes palearis*, differing in depth, in color, in the shorter upper jaw, and in other characters.

Type, no. 57828, U. S. National Museum (field no. 2439), a specimen 13.25 inches long from *Albatross* station 3788, and cotype, no. 20014, Stanford University Museum, a specimen 8.4 inches long from station 4267.

244. **Lycodes brevipes** Bean.

This species was found to be very common in the deep waters from Puget Sound to Shelikof Strait. Sixty-three specimens, 2.5 to 10.75 inches long, are in the collection. These were taken at stations 2848, 4201, 4218, 4246, 4248, 4250, 4252, 4254 to 4256, 4258, 4275, 4280, 4283, 4285, 4291 to 4293, 4295, and 4296.

Originally described by Bean (1891) from Unga and Nagai islands, at Albatross station 2848; recorded also from stations 3216, 3225 to 3227, 3263, 3309 to 3311, 3313, and 3330, located north and south of the Aleutian Islands and in Bristol Bay (Gilbert 1895), and from off Karluk (Jordan & Gilbert 1896).

245. **Lycodalepis turneri** Bean.

Recorded by Bean (1879) as *Lycodes turneri* from St. Michael and (1882) as *Lycodes coccineus* from Big Diomede Island, Bering Strait. Point Barrow (Murdoch 1885) as *Lycodes turneri* and *Lycodes coccineus*. Norton Sound (Nelson 1887) and Point Barrow (Scofield 1899), both as *Lycodalepis turneri*.

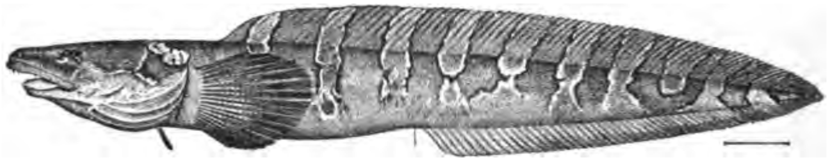


FIG. 121.—Lycodalepis turneri Bean.

246. **Furcimanus diaptera** (Gilbert).

Thirty-nine specimens of this species, ranging in length from 2.45 to 12.5 inches long, were taken at stations 4198, 4236, 4238, 4251, 4255.

The color in all the large specimens is uniform and the bars are lacking; in the medium-size ones the bars are very faint; some of the small ones are nearly plain, others distinctly barred.

Recorded by Gilbert (1895) as *Lycodes diapterus* from north of Unalaska, at stations 3227, 3324, 3326, 3329 to 3332.

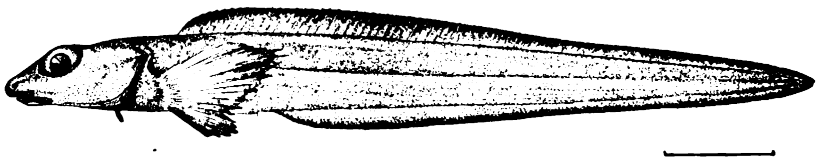


FIG. 122.—Furcimanus diapterus (Gilbert).

247. **Bothrocara pusilla** (Bean).

The collection contains 14 specimens, 4.75 to 6 inches long, dredged at stations 4251, 4252, 4255, 4256.

Originally described by Bean (1891) as *Maynea pusilla* from off Nagai Island, Albatross station 2848. North of Unalaska at stations 3224, 3227, 3330, and 3331 (Gilbert 1895).

248. **Bothrocara mollis** Bean. (Pl. XXI, fig. 2.)

Recorded from Albatross station 3634, off Bogoslof Island (Jordan & Gilbert 1899).

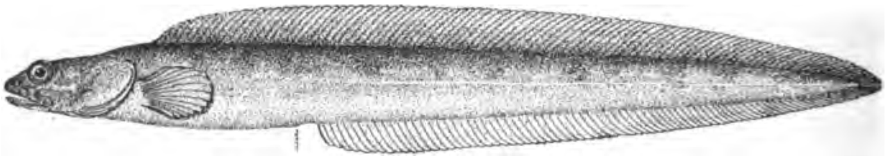
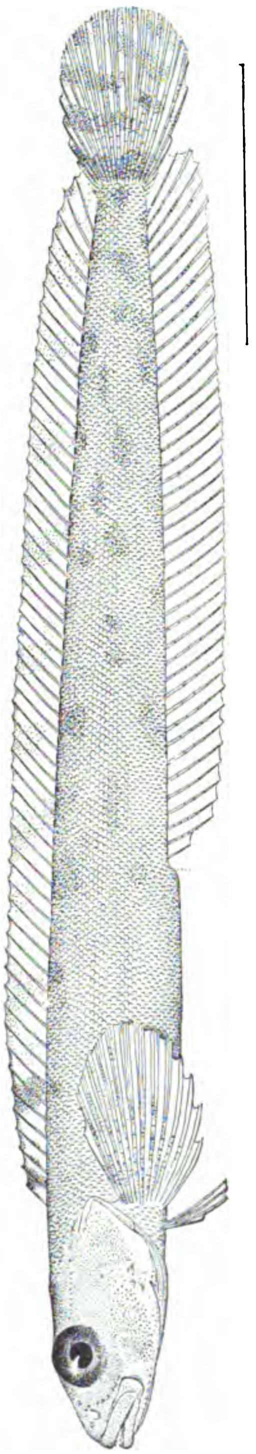


FIG. 123.—Gymnelis viridis (Fabricius).

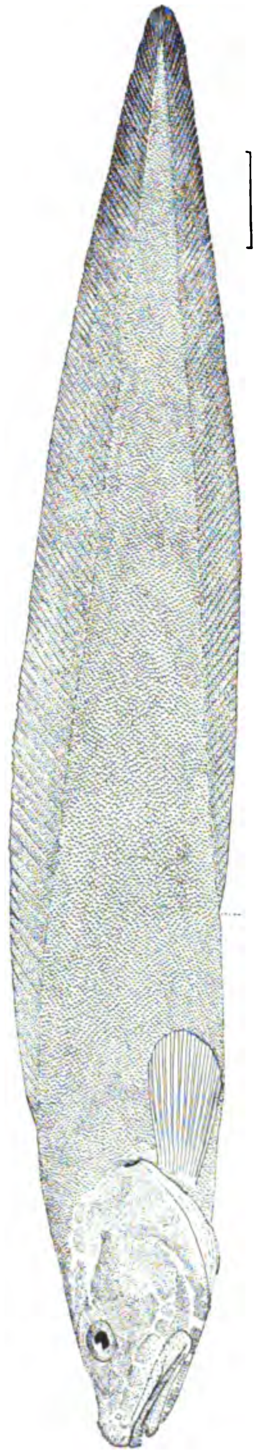
249. **Gymnelis viridis** (Fabricius).

Three specimens, 3 to 4 inches long, collected by Mr. Rutter at Karluk, June 8–10, 1903.

These specimens differ somewhat from current descriptions. The head is 8 not 6.5 in length, and color in alcohol is almost uniform cherry red; 2 of the specimens have a conspicuous white bar along the cheek, which is faint in the third specimen.



1. LUMPENUS MEDIUS (REINHARDT).



2. BOTHROCARA MOLLIS BEAN.

The species has been recorded (Bean 1882) from Coal Harbor, Shumagins; St. Michael, and Unalaska. Point Barrow (Murdoch 1885). St. Michael (Turner 1886). Unalaska and at station 3256 in Bristol Bay (Gilbert 1895). Karluk (Rutter 1899).

250. **Gymnelis stigma** (Lay & Bennett).

Originally described from Kotzebue Sound (1839); also recorded from Albatross station 3688, near St. Paul Island (Jordan & Gilbert 1899).

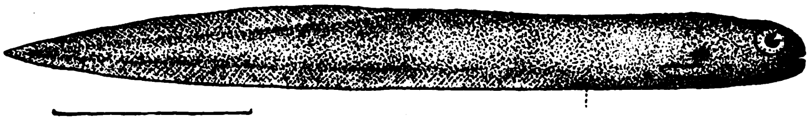


FIG. 124.—Melanostigma pammelas Gilbert.

251. **Melanostigma pammelas** Gilbert.

Described from the coast of southern Alaska, latitude 46° 10′ north, longitude 121° 58′ 45″ west, at Albatross station 3202, in 382 fathoms.

Family 47. LYCODAPODIDÆ.

252. **Lycodapus fierasfer** Gilbert.

This species is represented in the collection by 8 specimens, 2.5 to 6 inches long, dredged at stations 4225, 4250, and 4257. Recorded from north of Unalaska at station 3324 (Gilbert 1895).

253. **Lycodapus parviceps** Gilbert.

Originally described by Gilbert (1895) from station 3324, north of Unalaska Island.

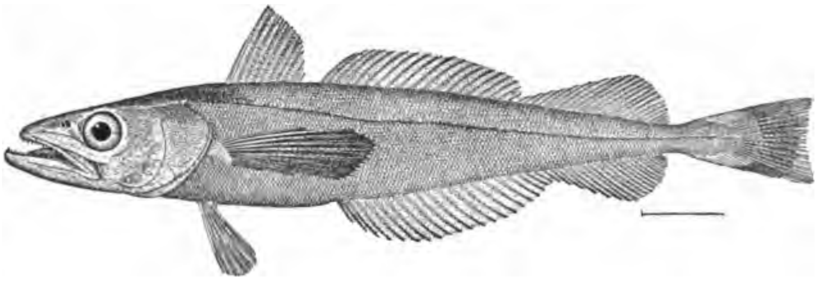


FIG. 125.—Merluccius productus (Ayres).

254. **Lycodapus extensus** Gilbert.

Originally described by Gilbert (1895) from station 3324, north of Unalaska.

Family 48. MERLUCCIDÆ.

255. **Merluccius productus** (Ayres).

We have one specimen, 4.5 inches long, collected by Mr. J. P. Todd near Seattle, 1903.

Family 49. GADIDÆ. The Codfishes.

256. **Boreogadus saida** (Lepechin).

Recorded from Kigiktowik, Norton Sound (Nelson 1887); St. Michael (Turner 1886); St. Michael and Cape Lisburne (Bean 1882); Point Barrow (Murdoch 1885); Port Clarence (Scofield 1899).

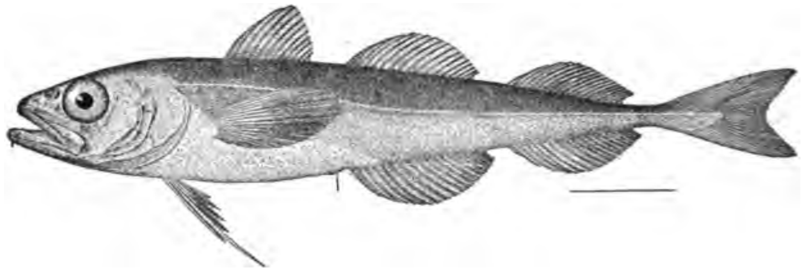


FIG. 126.—Boreogadus saida (Lepechin).

257. **Theragra chalcogramma** (Pallas). *Alaska Pollock.*

An abundant and widely distributed species. Examples were collected or seen as follows:

One specimen (no. 02899), 12 inches long, from station 4250; one (no. 02892), 11 inches long, from station 4246 (dorsal 14–16–18; anal 21–19); eight, 5.75 to 7 inches long, seined in Cleveland Passage; one (no. 02918), 10.5 inches long, from Skagway; one (no. 03002), 9.5 inches long, from station 4292; one, 8 inches long, from station 4296; twenty, 2.5 to 3 inches long, from station 4212; a few seen at Karluk and 2 at Shakan; 4 (20, 24, 24, and 24.5 inches long, weight 1, 2, 2.5, and 2.5 pounds) taken on a hook at Sand Point; 12 (average length 22.5 inches, average weight 2.75 pounds) taken over the rail with hand line at Fox Harbor. Others were taken or seen at the Chilkoot cannery, Cleveland Passage, Skagway (where many were taken on hook and line); Dundas Bay (several in salmon trap); Pavlof Harbor; Unalaska; Chignik Bay; Sitkoh Bay; Loring; Litnik Bay; and stations 2844, 2864, 3781 (off Kamchatka), 4246, 4250, and 4255; and a specimen 6.5 inches long collected by Mr. M. C. Marsh at St. Paul Island, Pribilof Group, August 7, 1906.

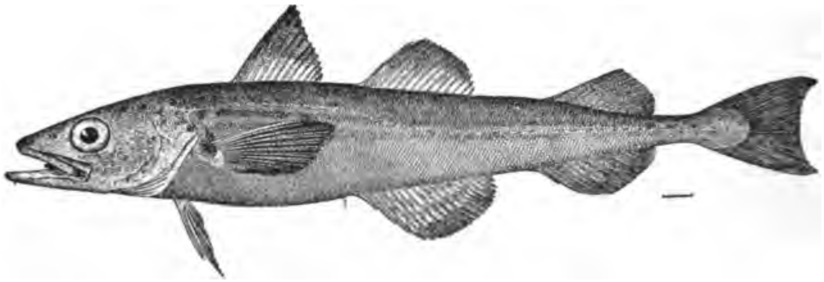


FIG. 127.—Theragra chalcogramma (Pallas).

The following table exhibits the variation in the dorsal and anal rays:

DORSAL AND ANAL FIN COUNTS IN SPECIMENS OF THERAGRA CHALCOGRAMMA.

No.	Locality.	Length.	Dorsal.	Anal.
		Inches.		
2918	Skagway	10.00	12-15-18	18-17
3002	Station 4292	9.50	12-14-19	17-19
2892	Station 4246	11.25	14-16-18	21-19
2899	Station 4250	12.00	13-13-19	18-19
	Station 4292	8.00	13-16-18	18-20
	Cleveland Passage	7.00	12-14-16	18-18
	do	5.50	12-13-16	18-17
	do	6.25	13-15-15	18-18
	do	6.00	13-13-18	17-18
	do	6.00	12-14-18	17-17
	do	5.75	11-15-16	18-17
	do	5.75	12-15-16	18-17

The species has been previously recorded (Bean 1882) as *Pollachius chalcogrammus* from Chugachik Bay and Refuge Cove, Cook Inlet; Pirate Cove and Humboldt Harbor, Shumagins; Iliuliuk; Chernofski; Unalaska; and Wrangell. Under the same name by Gilbert (1895), from Captains Harbor, Unalaska, and at many stations in the shallow water of Bristol Bay and around the Aleutian Islands. Unalaska and St. Paul and St. George islands (Jordan & Gilbert 1899). Chignik Bay (Scofield 1899).

258. **Theragra fucensis** (Jordan & Gilbert).

This species has not heretofore been recorded from Alaskan waters, though Scofield and Seale took in Chignik Bay a specimen which seems as near *T. fucensis* as *T. chalcogrammus*. It is very probable that the 2 species intergrade, the northern specimens representing what is now known as *T. chalcogrammus*, and the southern *T. fucensis*. If this is so, the name *T. chalcogrammus* should be retained for both. Our collection contains but a single example, no. 08122, a specimen 10 inches long taken at Loring by the *Albatross* in 1905.

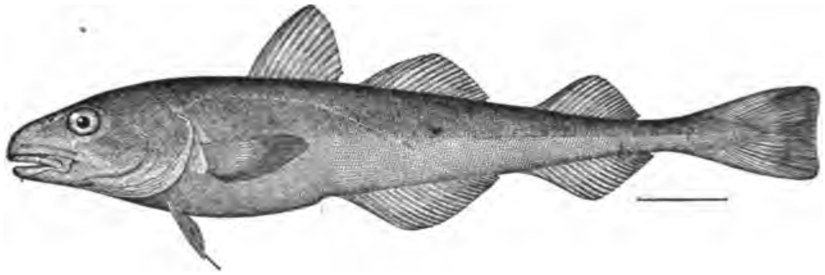


FIG. 128.—Eleginus navaga (Kölreuter).

259. **Eleginus navaga** (Kölreuter).

This codfish is common and at places abundant along the entire Alaskan coast. It is represented in our collections by specimens from various localities extending from Puget Sound to the Alaskan peninsula and across to Kamchatka. Forty-eight specimens, from 1.5 to 13 inches long, are in the collection from the following places: Admiralty Island; Port Alexander; Litnik Bay; Karluk; Uyak Bay; Unalaska; Petropaulovsk, and Tareinski Harbor in Kamchatka, and stations 4202, 4213, 4218 to 4220, 4268, 4271, 4272, 4275, 4277, 4278.

The usual descriptions of *Eleginus navaga* and *Microgadus proximus* refer to the same characters so seldom, except in features in which they happen to be alike, that from these characters it is impossible to compare the species, and the only way given to separate them is by dissection and a comparison of the transverse processes of the vertebræ. We find that the following comparisons are helpful, and that the species may be separated by their use:

In *proximus* the first dorsal has 14 rays.

In *navaga* the first dorsal has 13 rays.

In *proximus* first anal base=second dorsal base, and is 1.5 in head.

In *navaga* first anal base=second dorsal base, and is 1.15 in head.

In *proximus* the barbel is longer than pupil.

In *navaga* the barbel is equal to or less than pupil.

E. navaga has been recorded (Bean, 1882, as *Tilesia gracilis*) from Port Chatham, Cook Inlet; St. Paul, Kodiak; St. Michael. Port Clarence, Golwin Bay (Townsend 1887) as *Pleurogadus navaga*. St. Michael (Nelson 1887). St. Michael and Unalaska (Turner 1886). Port Clarence (Scofield, 1899).

260. **Microgadus proximus** (Girard).

This species was not found to be abundant, but was taken at various places from Seattle to Unalaska. Sixty-four specimens 1.25 to 10.5 inches long were secured from station 2869; Seattle; Cordova Bay; Chasina Anchorage; Cleveland Passage; Hunter Bay; Litnik Bay; Karluk, and Unalaska.

It was recorded from Yakutat Bay by Bean (1882).

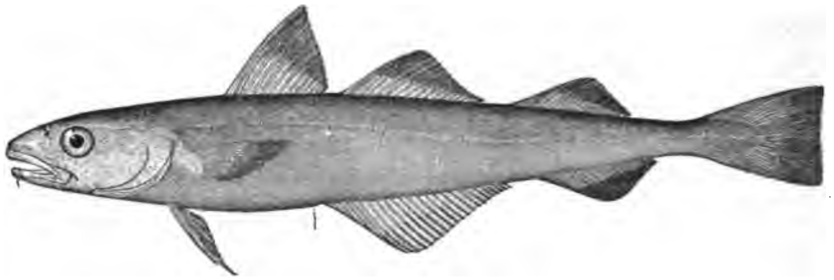


FIG. 129.—Microgadus proximus (Girard).

261. **Gadus macrocephalus** Tilesius. *Alaska Cod.*

We have in our collection 25 specimens 3.75 to 18 inches long taken by the *Albatross* at various times from 1894 to 1900 at the following places: Stations 3462 and 3600; Killisnoo; Ikatan Bay; Morzhovoi and Petropaulovsk.

This species was one of the common fishes taken with hook and line, chiefly over the rail of the ship, and at many stations. At Litnik Bay 9 were taken in this manner, average weight 5⅞ pounds, average length 25⅔ inches; at Alitak Bay, 2, weighing 6 and 7 pounds and having a length of 23 and 26.5 inches, respectively; at Chignik Bay, 7, weighing from 7 to 14 pounds, total weight 66 pounds, length ranging from 26 to 33 inches, average length 28.64 inches; at Sand Point, Shumagin Islands, 7, weighing from 5 to 10 pounds, total weight 66 pounds, length ranging from 26 to 34.5 inches, average length 30.35; at Fox Harbor, 12, average length 27.33 inches and average weight 8 pounds; at Uyak Bay, 12, weighing from 6 to 15 pounds, total weight 106 pounds, average 8⅚ pounds, length ranging from 25 to 36 inches, average length 29.5 inches. Many were seen swimming about under the slaughterhouse, where several were gaffed. At Fox Bay several young were caught in a dipnet over the rail. These small ones often seek protection, and perhaps food also. under jelly fishes.

We have no record of any large examples of this cod from the Pacific. where it perhaps does not reach a weight exceeding 15 or 20 pounds. It reaches a much larger size in the Atlantic. The Gloucester Times of February 1, 1907, records the capture by Mr. Thomas Jesso at Little Bras d'or (Cape Breton) of a codfish 6 feet 4 inches long, weighing 142 pounds, and states that this is one of the largest ever caught. He states, however, that he has seen whole boat loads ranging from 30 to 80 pounds. The average of those brought to Gloucester probably does not exceed 15 pounds.

Recorded by Bean (1882) as *Gadus morrhua* from Sitka; Old Sitka; off Marmot Island; St. Paul, Kodiak; Popoff Strait; Belkofski; Iliuliuk; Chernofski; Unalaska; St. Paul Island; Kygani Straits. Turner (1886), Shumagin Islands; Cook Inlet; throughout the Aleutian Islands. Gilbert (1895), Bering Sea at stations 3224, 3226, 3285, 3291, and 3301. Jordan & Gilbert (1899), Karluk; Belkofski; Unga; Unalaska; St. Paul and St. George. Scofield (1899), Chignik Bay.

262. **Antimora microlepis** Bean.

The collection contains a single example, no. 1315, 21 inches long, taken by the *Albatross* in Bering Sea, 1895. The species was recorded from stations 3330 and 3331, Bering Sea, by Gilbert, 1895.

263. **Lota maculosa** (Le Sueur). *Ling.*

Said to be common in Lake Bennett, Tagish Arm, Lake Atlin, and probably in all suitable waters in the Yukon basin.

Two specimens were secured in Lake Bennett in July, 1903, one 4.5 inches long taken along shore and the other 25 inches long in a gill net set at the bottom of the lake.

Recorded by Murdoch (1885) from Meade and Kuahru rivers. Nelson (1887) Nulato; Fort Reliance; Andreafski, Yukon River; Kotlik. Turner (1886), Yukon River. Gilbert (1895), Nushagak.

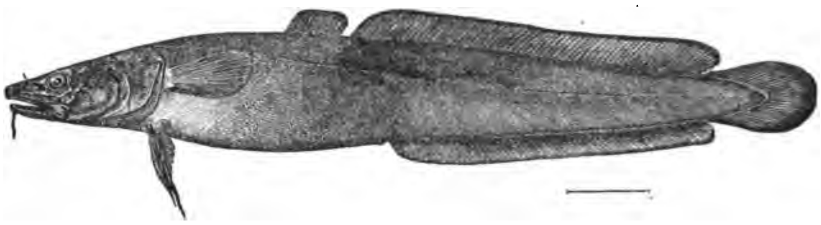


FIG. 130.—Lota maculosa (Le Sueur).

Family 50. MACROURIDÆ.

264. **Albatrossia pectoralis** (Gilbert).

Recorded from Albatross station 3634, off Bogoslof Island (Jordan & Gilbert 1899).

265. **Bogoslovius clarki** (Jordan & Gilbert). (Pl. XXII.)

Originally described from Albatross station 3634, off Bogoslof Island (Jordan & Gilbert 1899).

266. **Bogoslovius firmisquamis** (Gill, & Townsend).

We have a single specimen 21.5 inches long from Albatross station 3274, Bering Sea, June 27, 1890.

267. **Chalinura serrula** (Bean).

Originally described by Bean (1891) from east of Prince of Wales Island, Albatross station 2859.

268. **Macrourus acrolepis** (Bean).

The collection contains 2 specimens, nos. 2601 and 2599, 5 and 8 inches long, dredged at station 3784, north of Aleutian Islands, 1900. Recorded from Albatross station 3634, off Bogoslof Island (Jordan & Gilbert 1899).

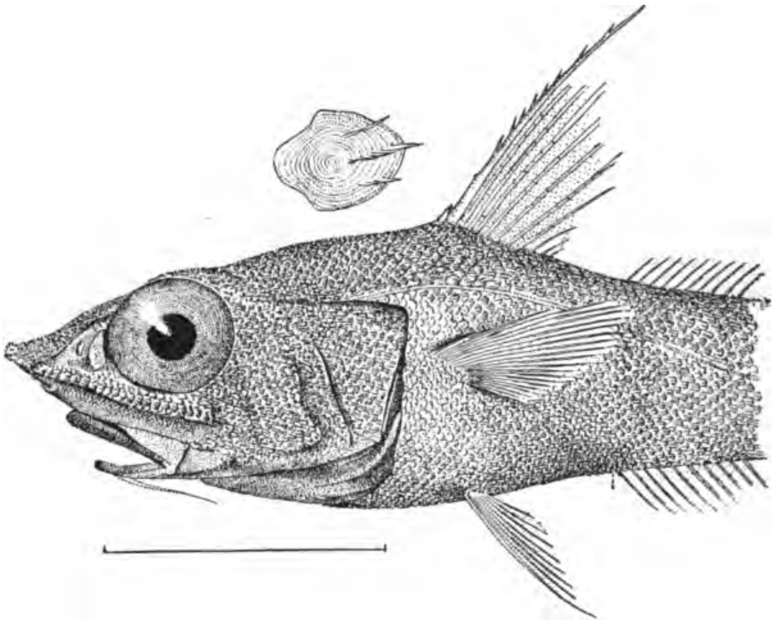


FIG. 131.—Macrourus acrolepis (Bean).

269. **Macrourus cinereus** (Gilbert).

We have 4 specimens, 7.5 to 17.5 inches long, dredged in 660 fathoms at station 3634, in Bering Sea, July 7, 1896, and one specimen, no. 2959, 17 inches long, dredged at station 4267, off Cape Edgecumbe, 1903.

Originally described by Gilbert (1895) from north of Unalaska Island at stations 3307 and 3329; has been recorded from station 3634, off Bogoslof Island (Jordan & Gilbert 1899).

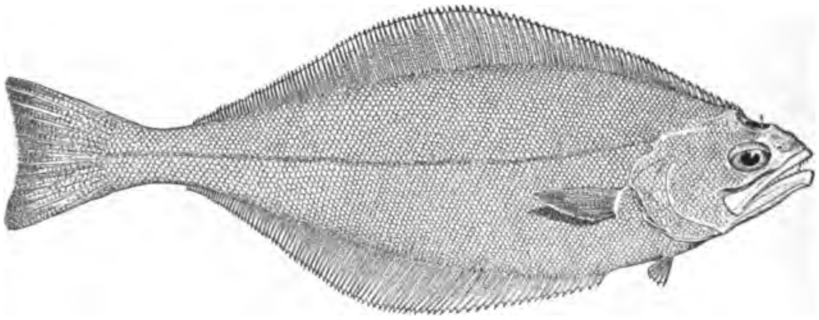
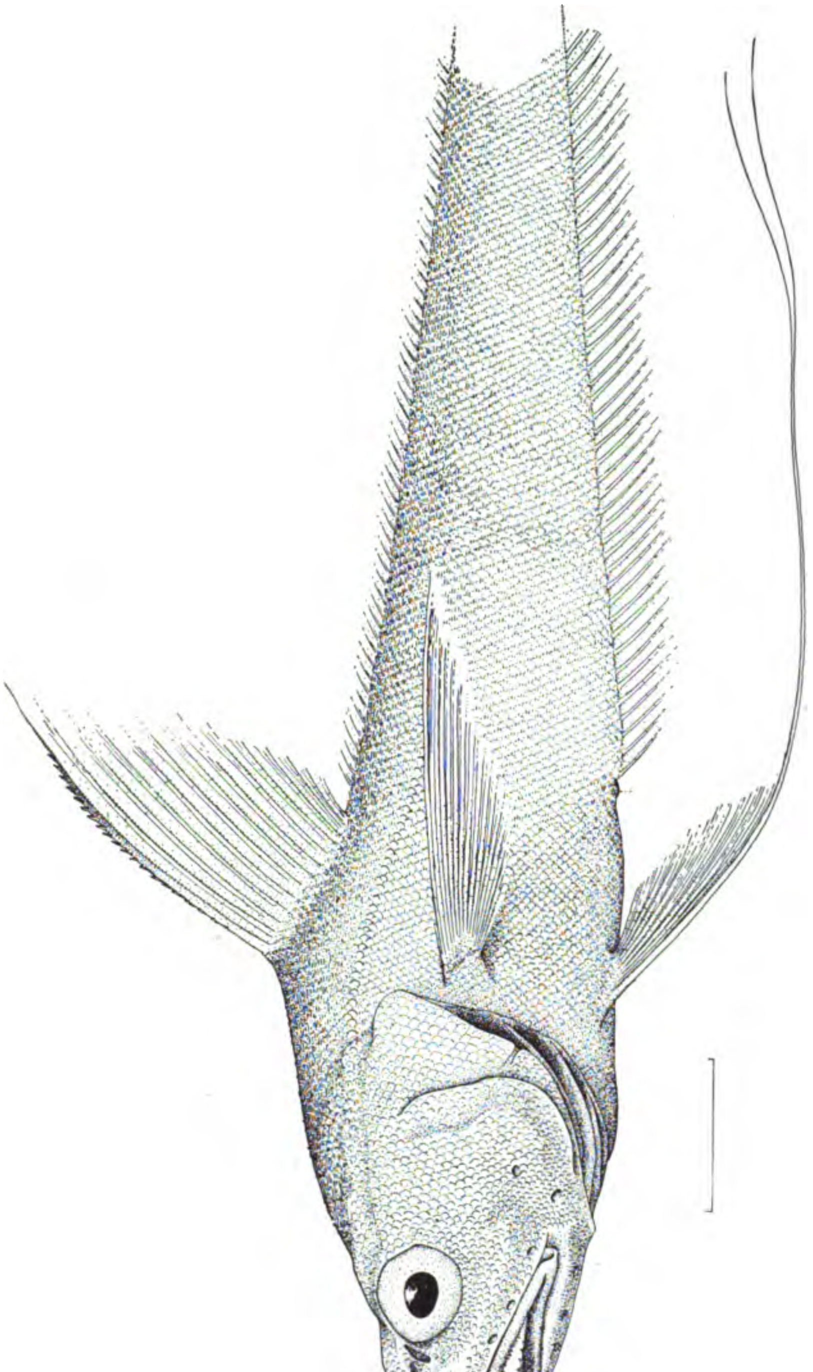


FIG. 132.—Atheresthes stomias (Jordan & Gilbert).

Family 51. PLEURONECTIDÆ. The Flounders.

270. **Atheresthes stomias** (Jordan & Gilbert).

Seven specimens, 6 to 28 inches long, are in the collection from Attu Island, and Bering Sea (August 10, 1895) and stations 3789, 4223, 4283. Others were seen or collected at Boca de Quadra; Behm Canal; Loring; in trap at Dundas Bay; and at stations 4231 and 4272; and one, 28 inches long, in very bad



BOGOSLOVIUS CLARKI JORDAN & GILBERT. TYPE.

condition, was collected at station 3608, Bering Sea. This large specimen differs from current descriptions in having the teeth not conspicuously arrow-shaped (a few are faintly so), and in having the interorbital broad, 2 in eye, and not ridged. It gives the following measurements: Head 3.3 in length; depth 2.8; eye 5.1 in head; snout 3.6; maxillary 1.6; mandible 1.5; pectorals 2.5; caudal lunate, its length 1.65; dorsal 110; anal 86; gillrakers 3+11, roughish, strong, broad, and short, longest about 3 in eye; scales smooth to the touch, not firmly attached; head, premaxillary and mandible scaled.

This species has been recorded (Bean, 1882) from Port Etches, off Afognak; off Popoff Island, Shumagins, Bean (1884), Wrangell and Naha Bay. Gilbert (1895), from many stations north and south of the Aleutian Islands and in Bristol Bay. Jordan & Gilbert (1899), Unalaska. Scofield (1899), Unga and Karluk, and Chignik Bay.

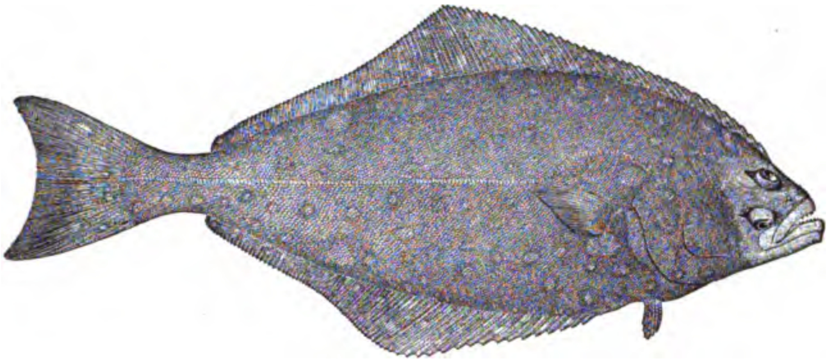


FIG. 133.—Hippoglossus hippoglossus (Linnæus).

271. Hippoglossus hippoglossus (Linnæus). *Halibut.*

Halibut were often seen and were often taken with hook and line in various places. No specimens were saved, but numerous examples were measured and weighed. The following table gives the results and the important data concerning the examples:

Locality.	Length.	Width.	Weight.	Locality.	Length.	Width.	Weight.
	Inches.	*Inches.*	*Pounds.*		*Inches.*	*Inches.*	*Pounds.*
Head of Karta Bay	70.0	....	[a] 155.0	Killisnoo	32.5	10.50	14.0
Cleveland Passage	58.0	18.00	78.0	Do	[d] 55.0	19.00	75.0
Do	41.0	12.50	30.0	Sitkoh Bay	29.0	....	9.5
Do	32.0	9.50	15.0	Do	30.0	....	10.5
Do	[b] 28.0	9.00	10.0	Fox Harbor	31.0	8.50	8.5
Do	27.0	9.00	8.0	Do	33.0	16.00	10.5
Do	30.5	9.75	11.0	Do	30.5	10.00	9.0
Dundas Bay	68.0	16.00	120.0	Do	24.5	6.00	12.5
Do	33.0	9.00	14.0	Sitka	20.0	7.00	4.5
Do	31.0	9.25	15.0	Port McArthur	51.0	17.00	60.0
Do	29.0	9.00	10.0	Do	....	....	[e]
Do	24.0	5.00	7.0	Shakan	11.0	6.00	8.0
Pavlof Bay	[c] 27.0	9.00	9.0	Do	36.0	13.00	16.0
Killisnoo	25.0	8.00	6.0	Do	27.0	11.00	8.0
Do	23.5	7.50	5.5	Loring	36.0	16.00	20.0
Do	20.0	6.50	3.5	Do	38.0	17.00	22.0
Do	23.5	7.75	5.5				

[a] In the stomach of the 155-pound example were found *Cancer antennarius*, fragments of clam shells, backbone of a fish and a large stone with partly digested barnacles on it. The brain with part of the skull of this example was saved; the brain was very small, no larger than 4 peas.

[b] The stomach of another example (from Cleveland Passage) contained 2 pollocks (*Theragra chalcogramma*), 2 anemones, and a lot of gravel. Another (Pavlof Bay) had a *Ceratocottus diceraus* in its stomach. One caught at Killisnoo (the 75-pound example) had about 6 large crabs in its stomach, and another from the same place contained a *Ceratocottus diceraus*.

[c] Stomach contained head of an *Enophrys bison*.

[d] Six large crabs in stomach.

[e] About 200.

In addition to the examples caught a few were seen swimming about at Uyak. Mr. John N. Cobb reports having seen and helped weigh at Juneau in the summer of 1904 a 365-pound halibut.

279. **Lepidopsetta bilineata** (Ayres).

This flounder is widely distributed. It takes the hook readily and was frequently taken over the rail. It was also frequently seen in the salmon traps and many were seined. Seventy-eight specimens, ranging in length from 2.25 to 17 inches, were secured, being taken at Marrowstone Point; Cordova Bay; Dundas Bay; Funter Bay; Hunters Bay; Ketchikan; Tongass Harbor; Sitka; New Morzhovoi; Akutan Bay; Agattu Island; Attu Island; Yakutat; Isanotski (Issannakh) Strait; Karluk; Unalaska; and stations 3598 (Bering Sea), 4193, 4212, 4219, 4262, 4268, 4269, 4272, 4273, 4277, and 4278.

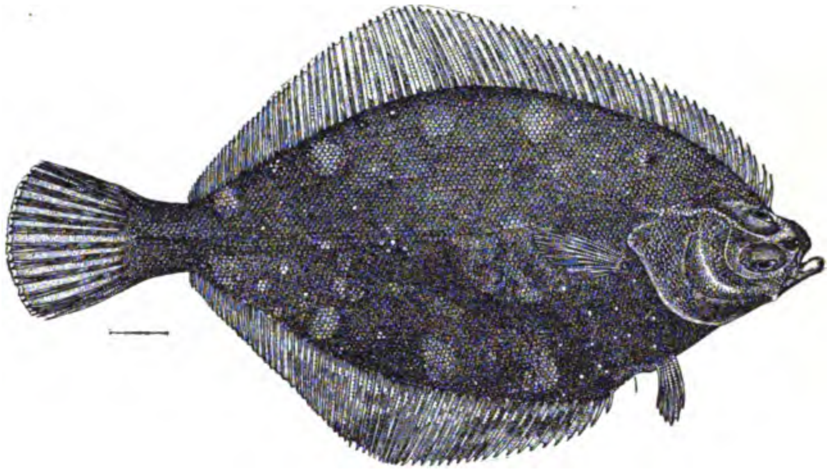


FIG. 137.—Lepidopsetta bilineata (Ayres).

It has also been recorded (Bean 1882) from Sitka; Port Mulgrave, Yakutat Bay; Chugachik Bay and Port Chatham, Cook Inlet; St. Paul, Kodiak; Humboldt Harbor and Popoff Straits, Shumagins; Iliuliuk and Nateekin Bay, Unalaska; Nazan Bay, Atka; Chichagof Harbor, Attu; St. Paul Island. Gilbert (1895) took it abundantly at Unalaska and Chernofski harbors, at Herendeen Bay and Hagemeister Island, and at 58 different stations in Bristol Bay. St. Paul Island, and station 3637, off St. George, and Unalaska (Jordan & Gilbert 1899). Chignik Bay (Scofield 1899).

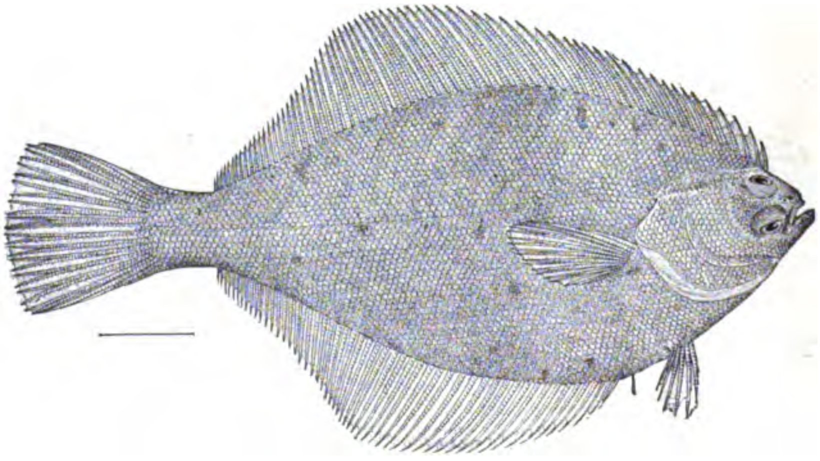


FIG. 138.—Limanda aspera (Pallas).

280. **Limanda aspera** (Pallas).

Taken at Pyramid Harbor; Cordova Bay; Karta Bay; Yakutat Bay; Shumagin Islands; and stations 3781 (off Kamchatka) and 4269. Five specimens preserved, ranging in length from 1.75 to 15 inches. The specimen from off Kamchatka is 15 inches long and agrees fairly well with current descriptions of the species, but differs in having the opercle and preopercle scaled and not naked below; the gillrakers are stout and short, about the length of pupil; caudal is truncate.

Recorded (Bean 1882), from Sitka; St. Paul, Kodiak Island; Humboldt Harbor, Shumagins. Bean (1884), Wrangell and Tongass. Gilbert (1895) took it in abundance at Herendeen Bay and at 24 different stations in Bristol Bay. Townsend (1887), Kotzebue Sound.

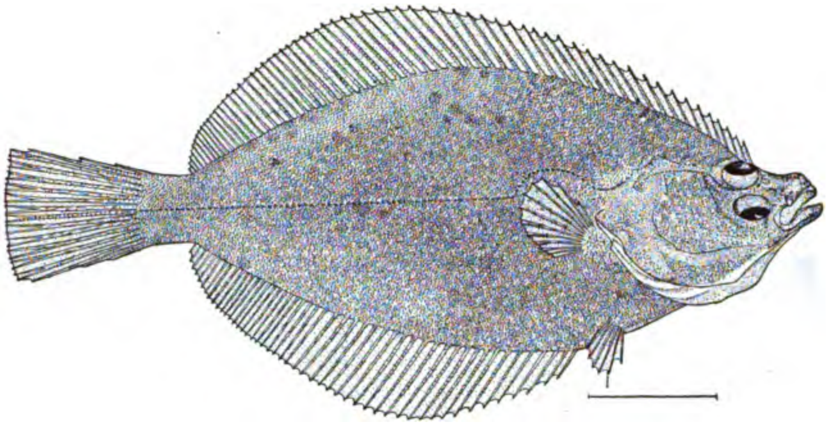


FIG. 139.—Limanda proboscidea Gilbert.

281. **Limanda proboscidea** Gilbert.

Originally described by Gilbert (1895) from stations 3239, 3240, and 3248 in Bristol Bay, and from Herendeen Bay.

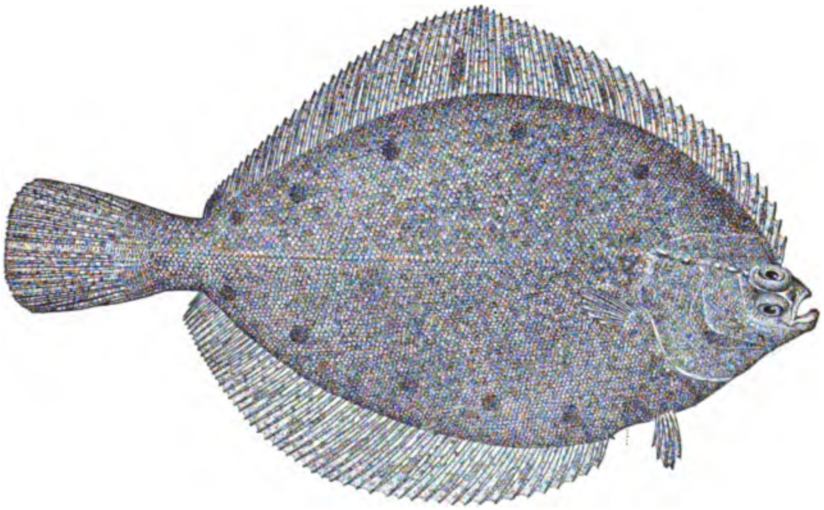


FIG. 140.—Pleuronectes quadrituberculatus Pallas.

282. **Pleuronectes quadrituberculatus** Pallas.

Eight specimens, 3.5 to 15 inches long, taken at Sand Point, Snug Harbor, New Morzhovoi, and station 4287. Recorded by Gilbert (1895) as abundant at Chernofski Harbor and Herendeen Bay, and at stations 3240, 3244, 3251, and 3252, Bristol Bay. Chignik Bay and Port Clarence (Scofield 1899.)

283. **Liopsetta glacialis** (Pallas).

We have 4 specimens, 6.75 to 9 inches long, collected by the *Albatross* on the Asiatic coast at Pertopaulski and Tareinski harbors (1900).

The species has been recorded from Hotham Inlet and Chamisso Island, Kotzebue Sound (Bean 1882). Unalaska and Attu islands and St. Michael (Turner 1886). St. Michael (Nelson 1887). Port Clarence (Scofield 1899). Mouth of Naknek and Nushagak rivers, and at station 3232 in Bristol Bay (Gilbert 1895).

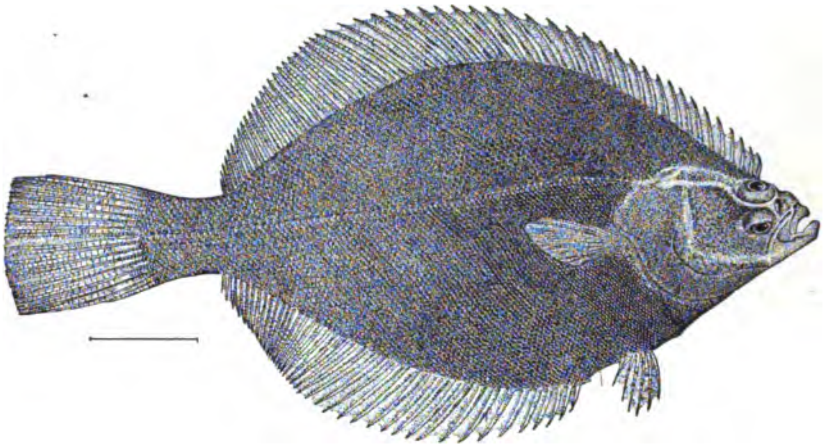


FIG. 141.—Liopsetta glacialis (Pallas).

284. **Platichthys stellatus** (Pallas).

This is apparently the most abundant and widely distributed flounder in Alaska, many large examples being frequently taken in salmon traps. We have 41 examples, ranging in length from 0.5 to 11.25 inches, taken at various places along the coast from Cape Flattery northward to the Alaskan peninsula and across to Kamchatka. The following localities are represented: Cape Flattery; Gabriola Island; Kilisut Harbor; Tribune Bay; Marrowstone Point; Mink Arm; Loring; Yes Bay; Helm Bay; Yakutat; Karluk; Nushagak; Unalaska; Petropaulski; and Tareinski Harbor.

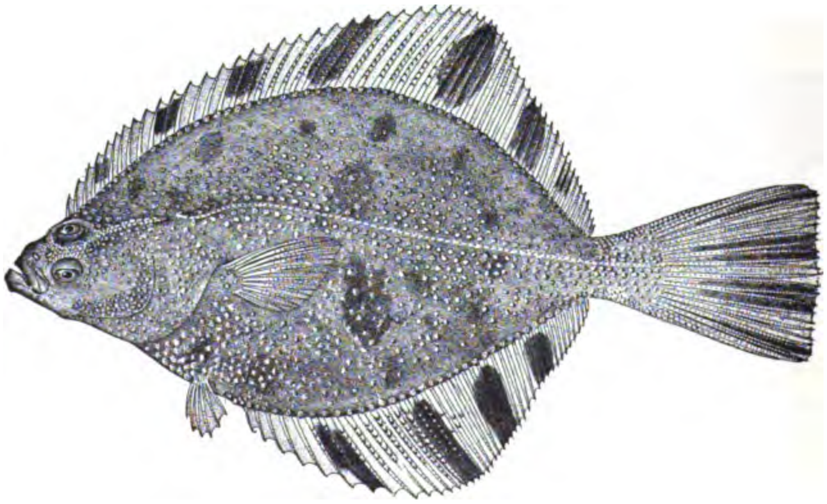


FIG. 142.—Platichthys stellatus (Pallas).

The two smallest specimens, those from Marrowstone Point, agree with the others in fin count, but differ somewhat in color, which is brown and mottled and flecked with white; a row of the white spots at bases of dorsal and anal more distinct than others. In the small specimens stellate prickles are present only along bases of dorsal and anal, with numerous pits, representing scales everywhere on body; in the medium size the scales are just beginning to appear along sides of body; in the large ones they are well developed all over the body.

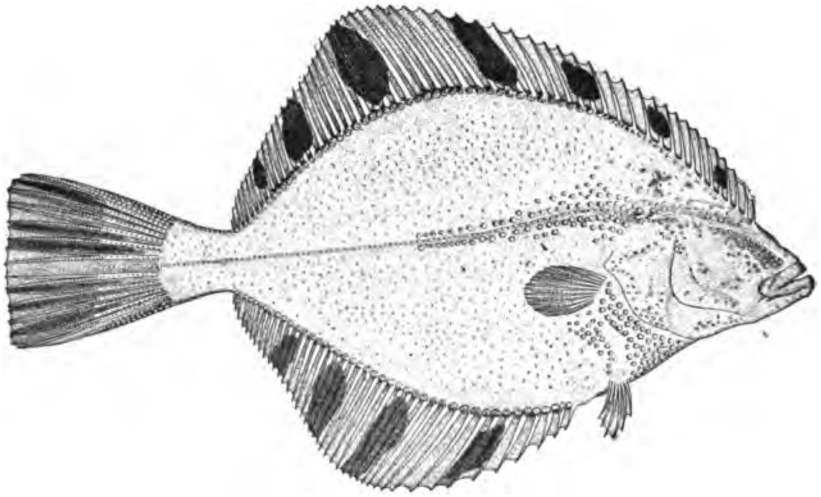


FIG. 143.—Platichthys stellatus (Pallas).

This species has been recorded (Bean 1882), as *Pleuronectes stellatus*, from Sitka; Port Mulgrave, Yakutat Bay; Chugachik Bay, Cook Inlet; St. Paul, Kodiak; Iliuliuk, Unalaska; St. Michael; Anderson River and Hotham Inlet, Kotzebue Sound. St. Michael and Unalaska (Nelson 1887). Mouth of the Nushagak River and stations 3229, 3235, 3239, 3240, and 3269, Bristol Bay (Gilbert, 1895). St. Paul; Unalaska, and Karluk (Jordan & Gilbert 1899). Port Clarence (Scofield 1899).

285. **Microstomus pacificus** (Lockington).

Eleven specimens ranging in length from 7.75 to 21 inches were secured at Isanotski (Issannakh) Strait, and stations 3447, 4230, 4233, 4234, 4264, 4293, 4296, and 4299. Most of these specimens are large (16 to 20 inches), and the number of dorsal and anal rays is more (dorsal 107, anal 91) than is usually given. The eye is slightly smaller, about 4 in head. The teeth in the lower jaw run from 16 to 20 and not 10.

The species is also recorded from stations 3216 and 3333, Alaskan peninsula (Gilbert 1895).

286. **Glyptocephalus zachirus** (Lockington).

Thirty-six specimens, from 3 to 18 inches in length. This deep-water flounder was found to be quite common all along the Alaskan coast, being taken at many stations between 4201, off Fort Rupert, Vancouver Island, and 4287 in Uyak Bay. Many specimens were taken or observed at the following dredging stations: 4201, 4219, 4221, 4223, 4224, 4226, 4227, 4230, 4231, 4233, 4234, 4236, to 4238, 4243, 4246, 4248 to 4251, 4254, 4259, 4268 to 4270, 4272, 4283, 4287, 4296, and 4299. Recorded from Bering Sea and north Pacific generally (Gilbert 1895).

287. **Citharichthys sordidus** (Girard).

We have a single specimen, no. 1680, 10.25 inches long, collected at Kyska Island. June, 1894. This extends the northern and western range of this species. It has not been recorded heretofore north of British Columbia.

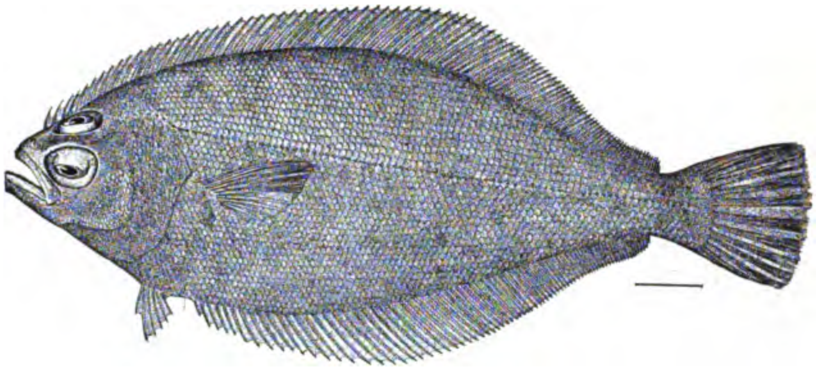


FIG. 144.—Citharichthys sordidus (Girard).

288. **Citharichthys stigmæus** Jordan & Gilbert.

The collection contains 1 specimen 4 inches long collected by J. P. Todd, near Seattle, in 1903, and 2 specimens, 3.75 to 4.25 inches long dredged at station 4219.

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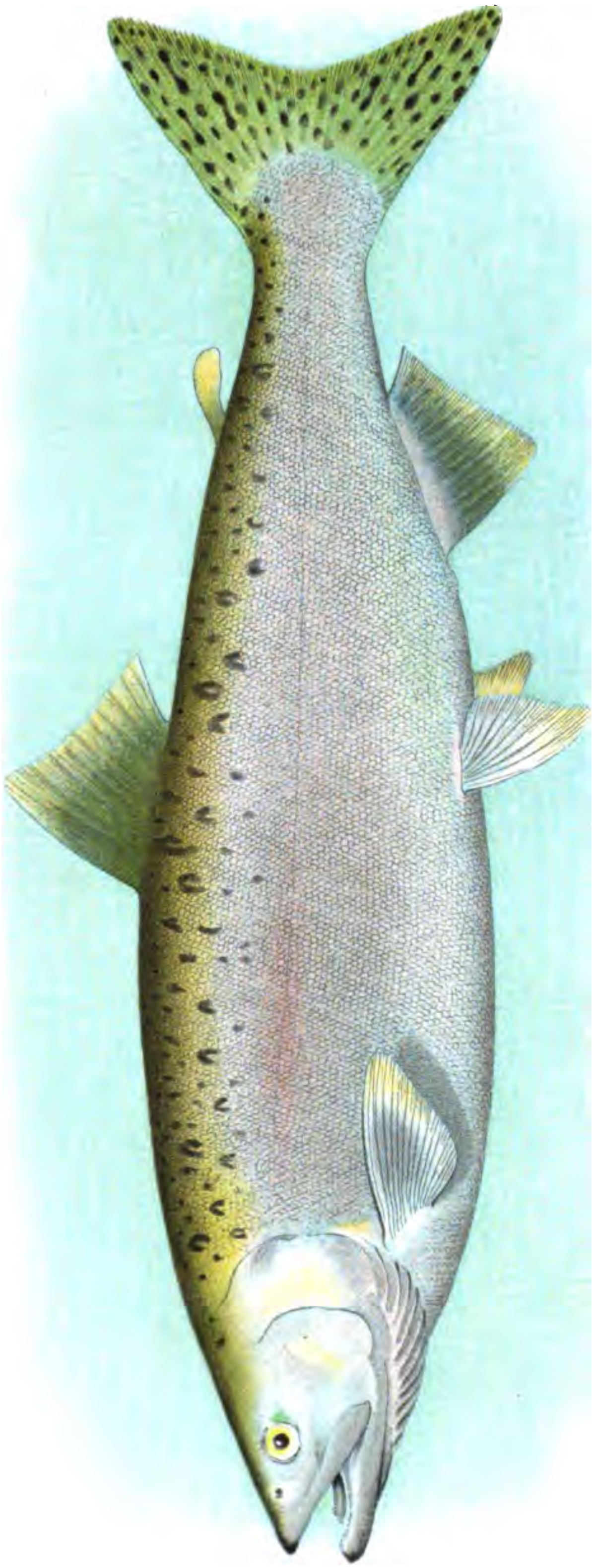

HUMPBACK SALMON
Adult male

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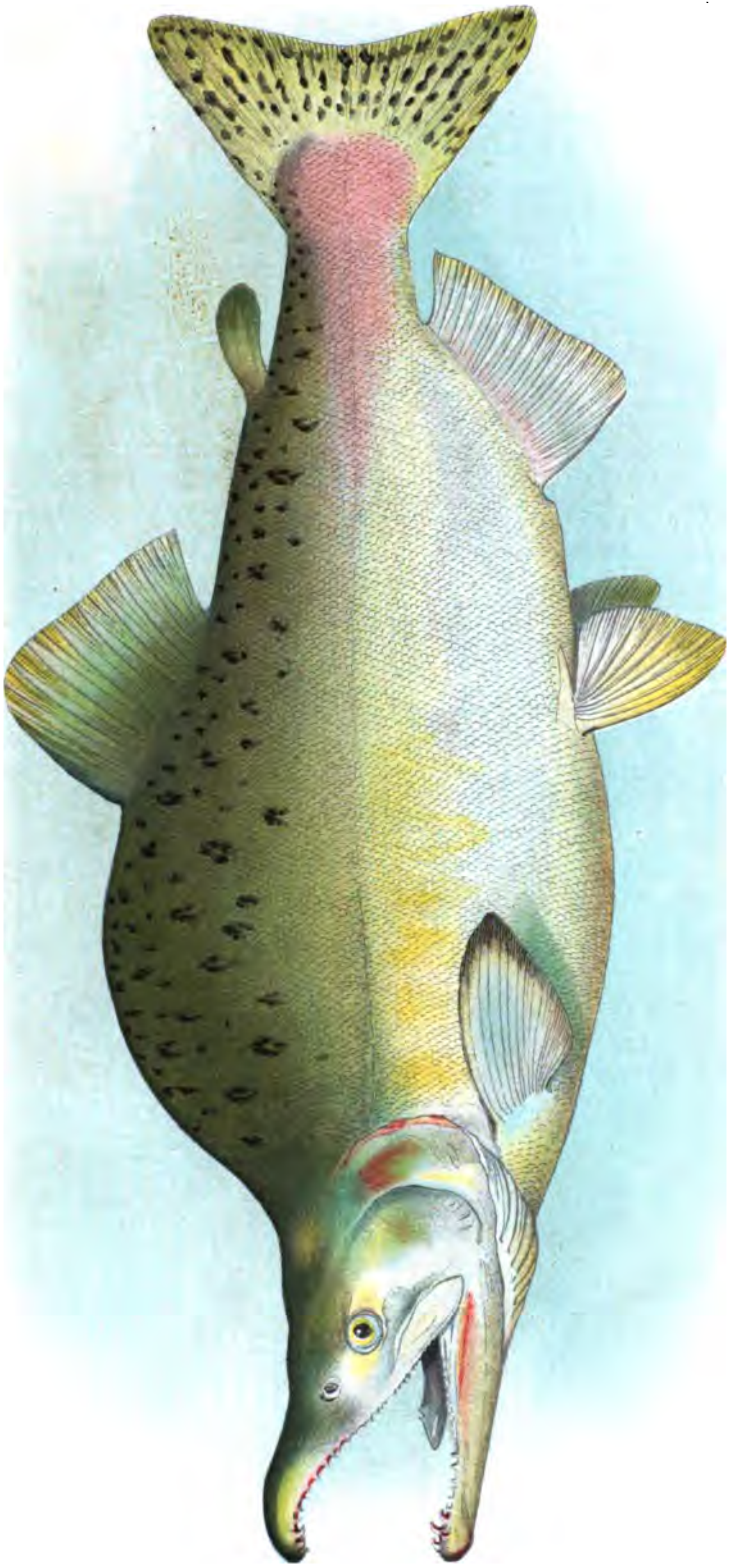

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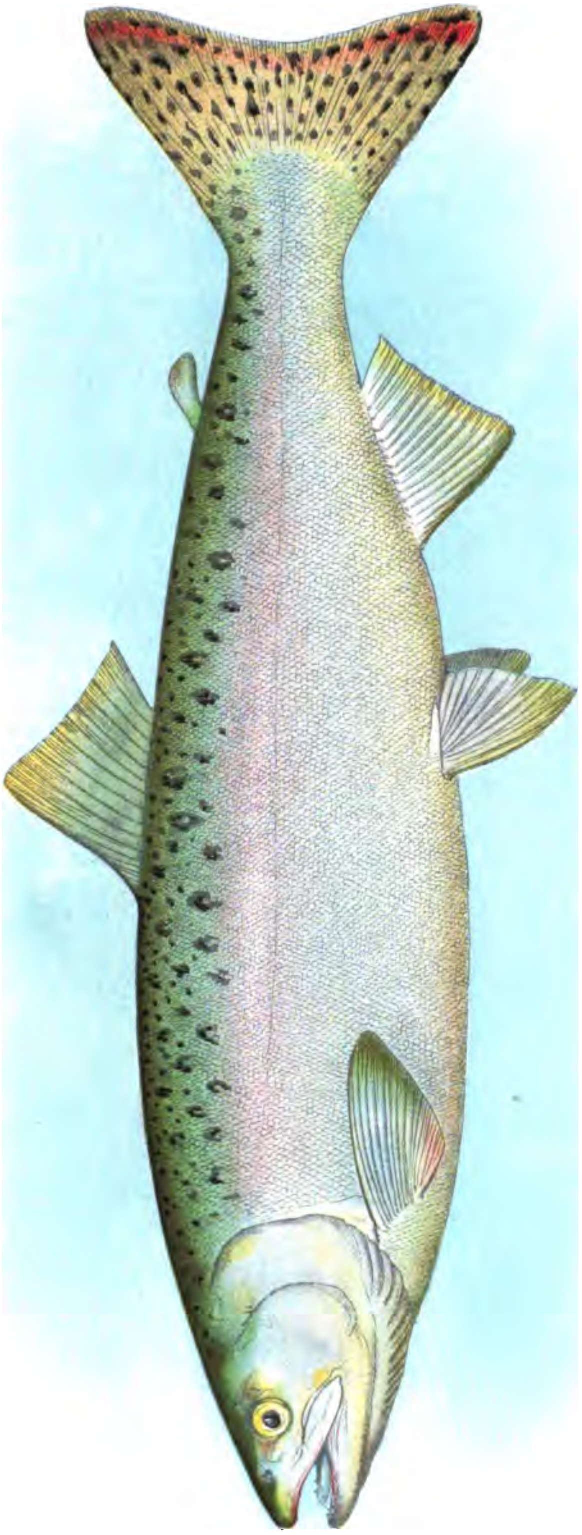

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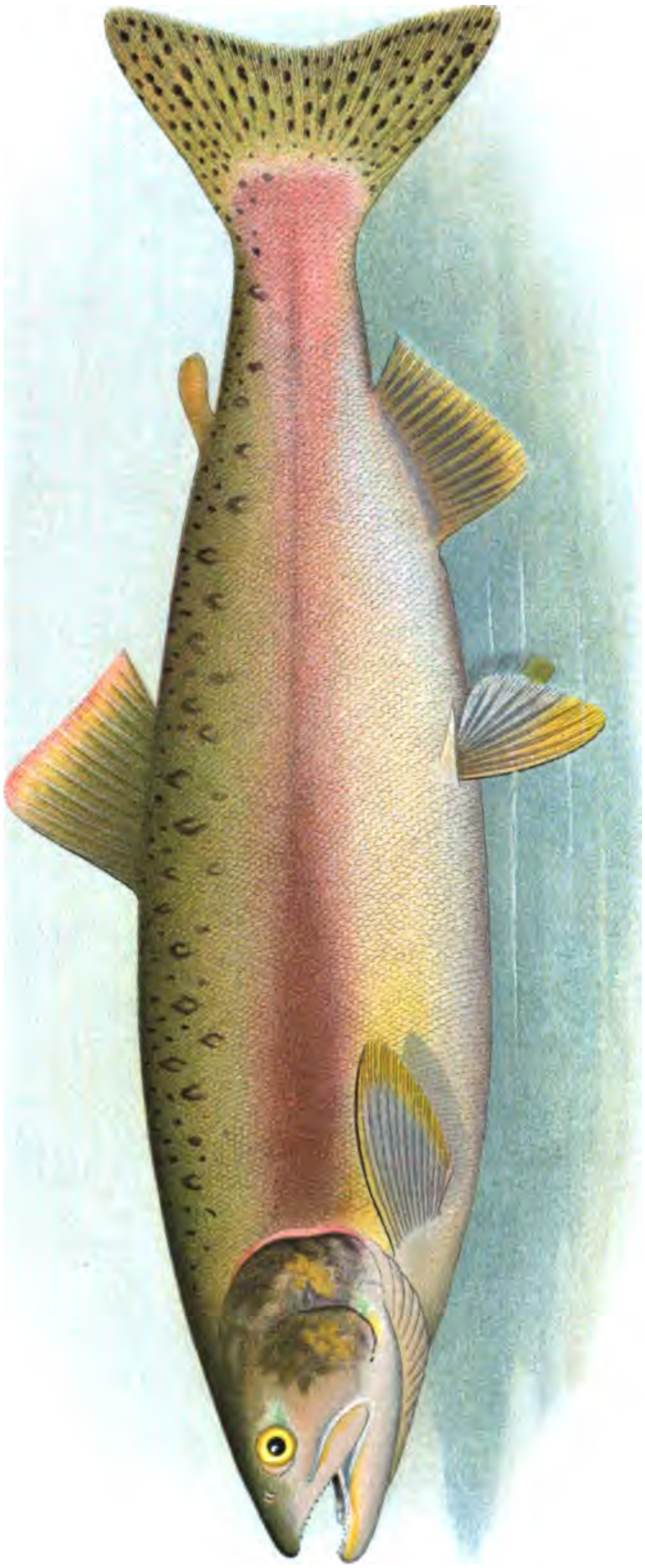

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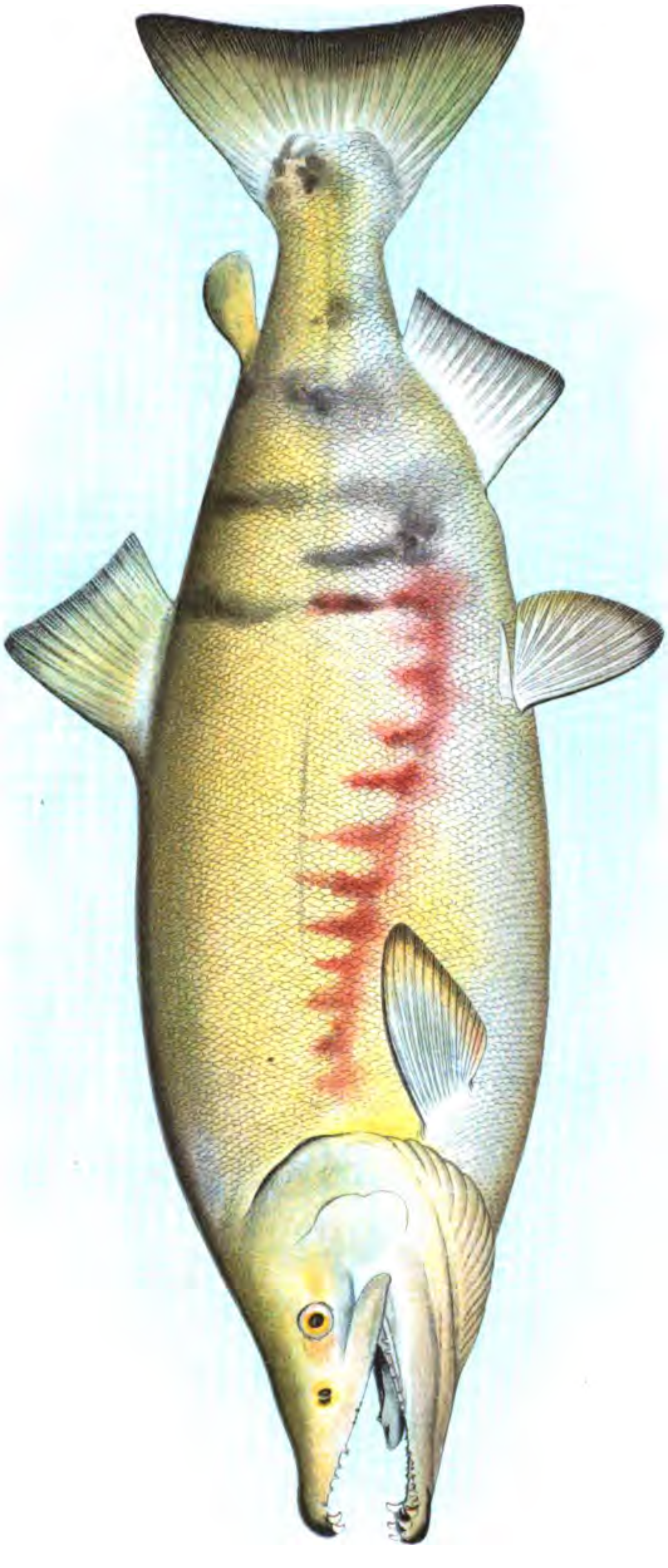

DOG SALMON
Breeding male

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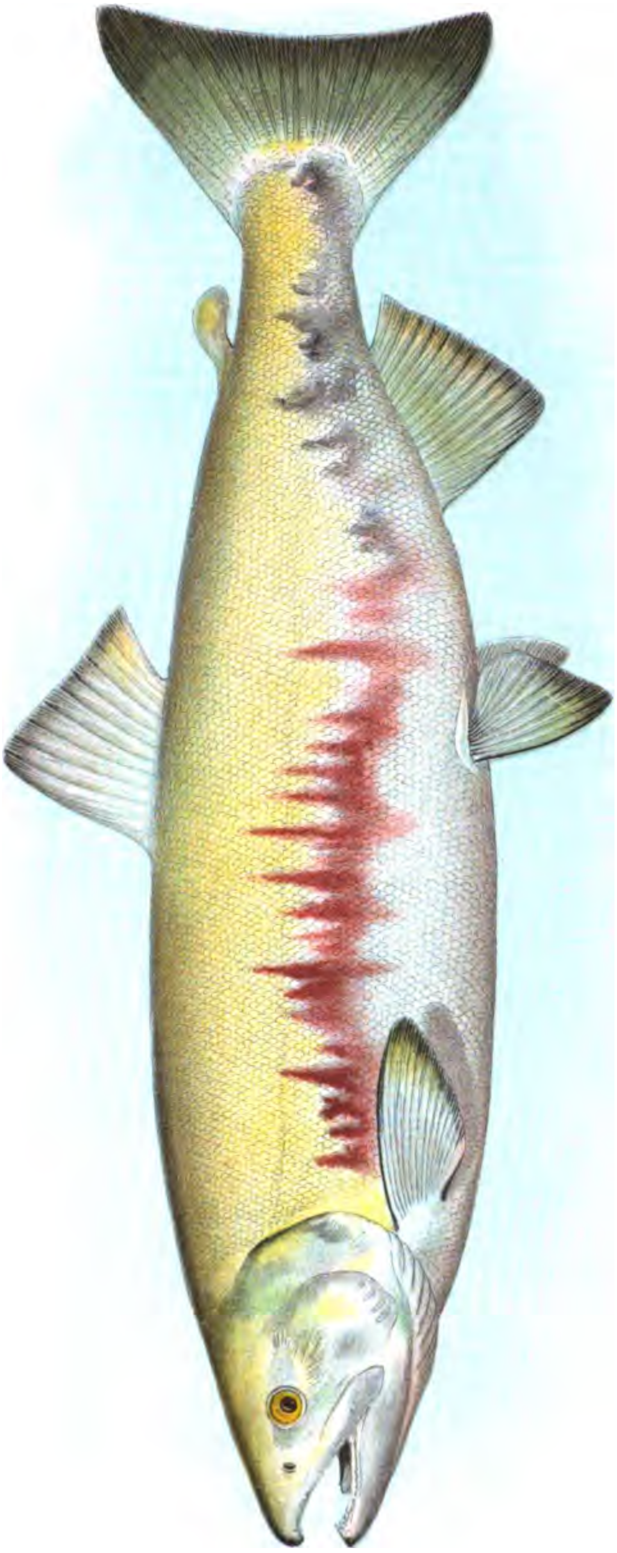

DOG SALMON
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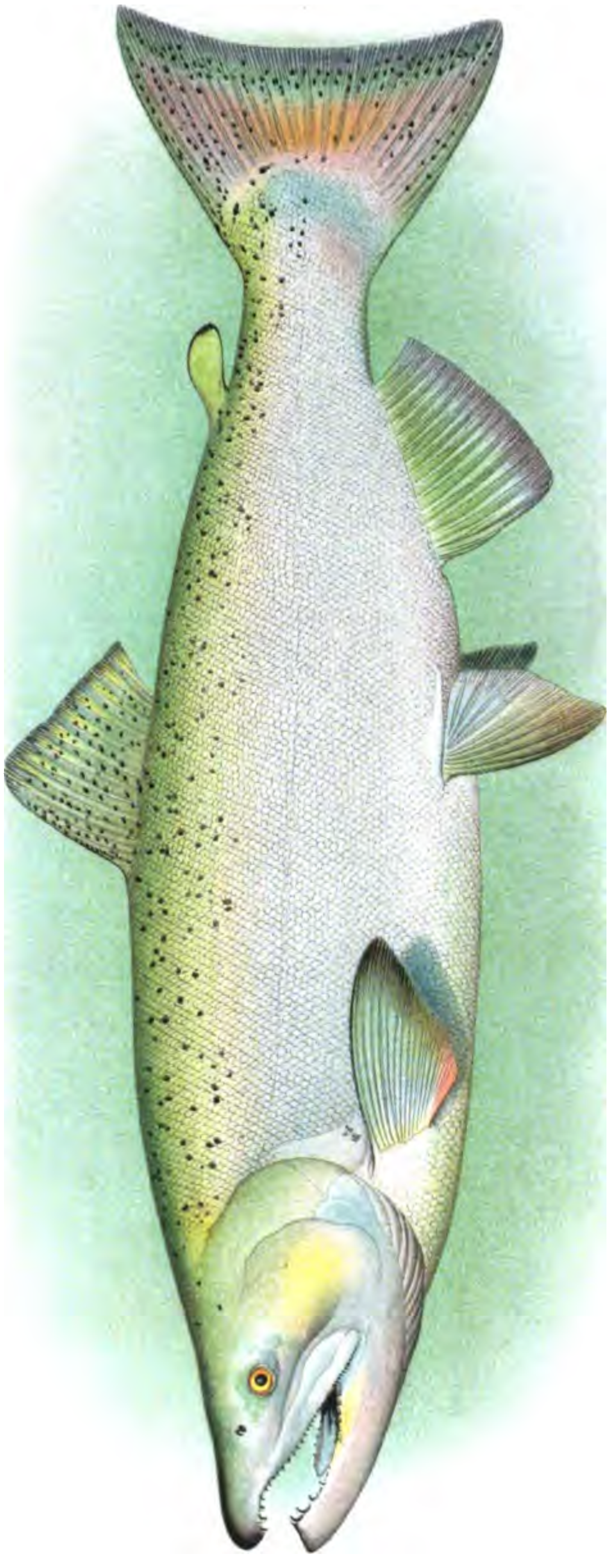

CHINOOK SALMON
Adult male

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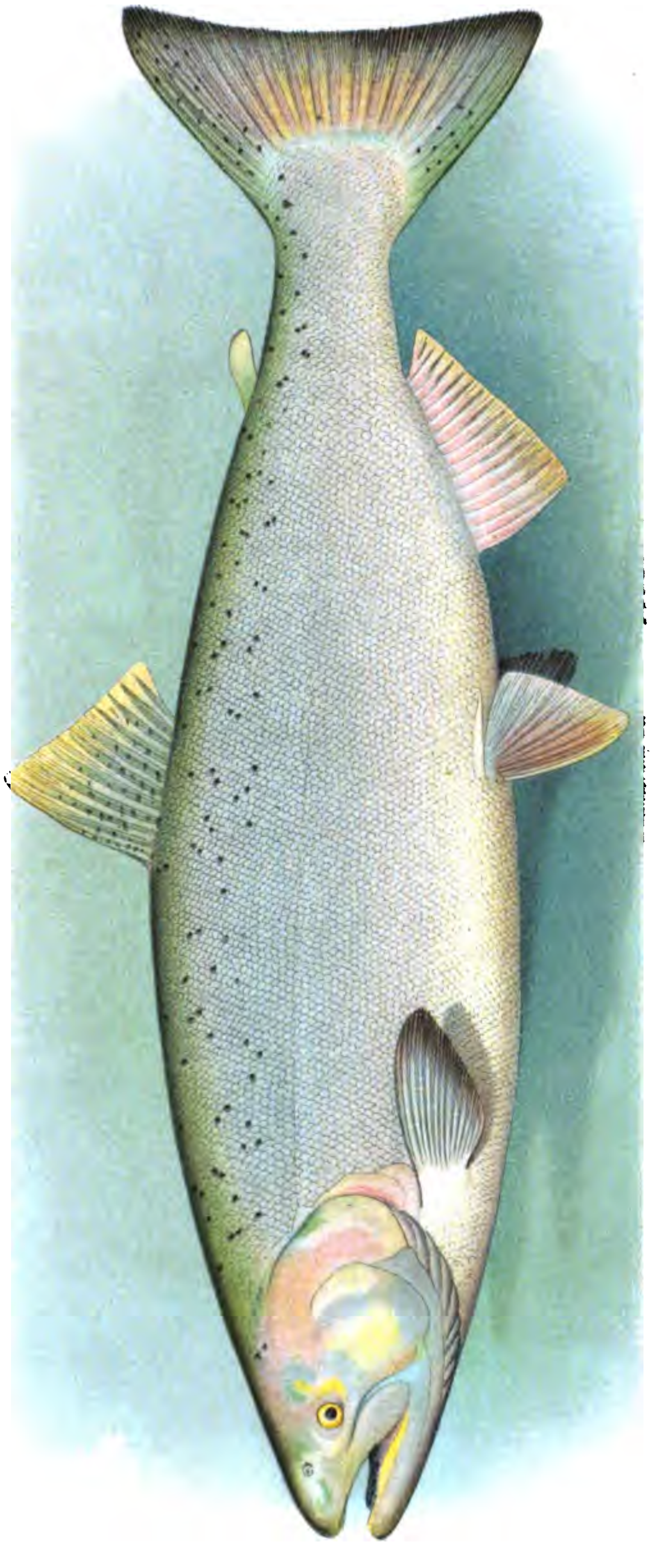

CHINOOK SALMON
Adult Female

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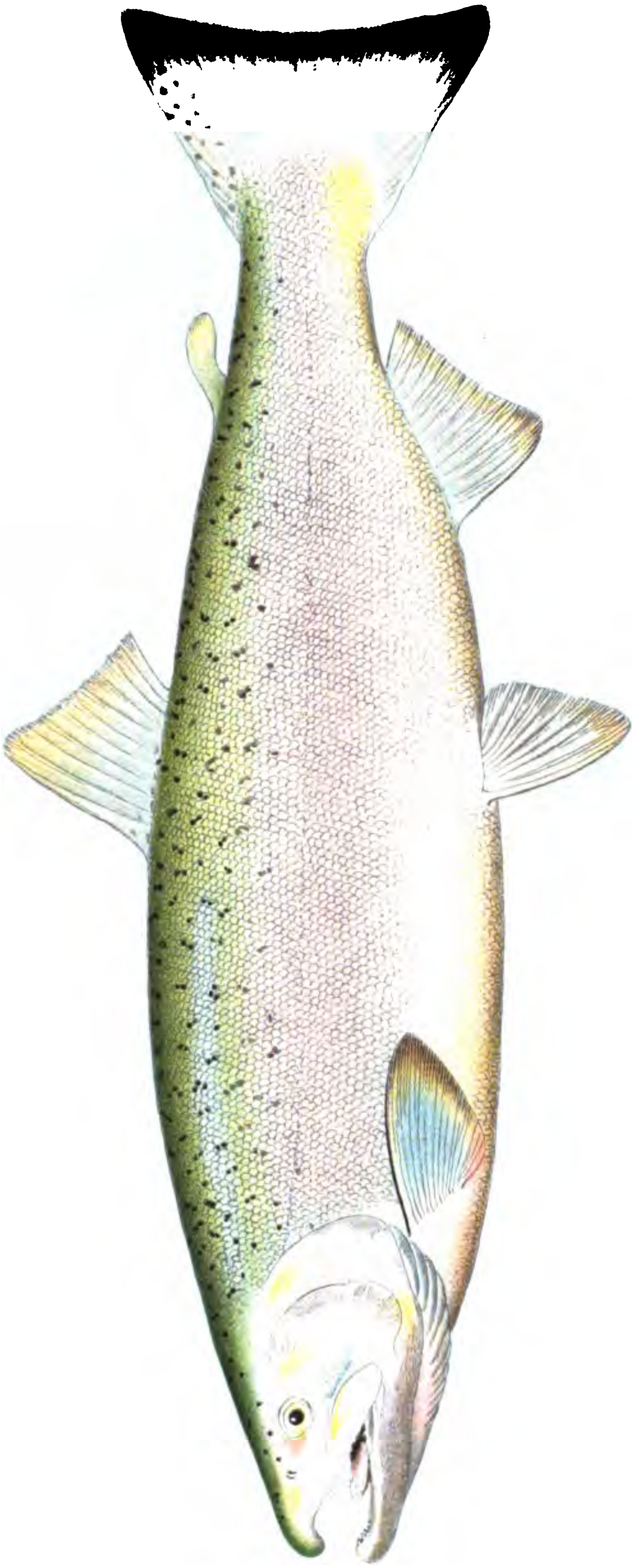

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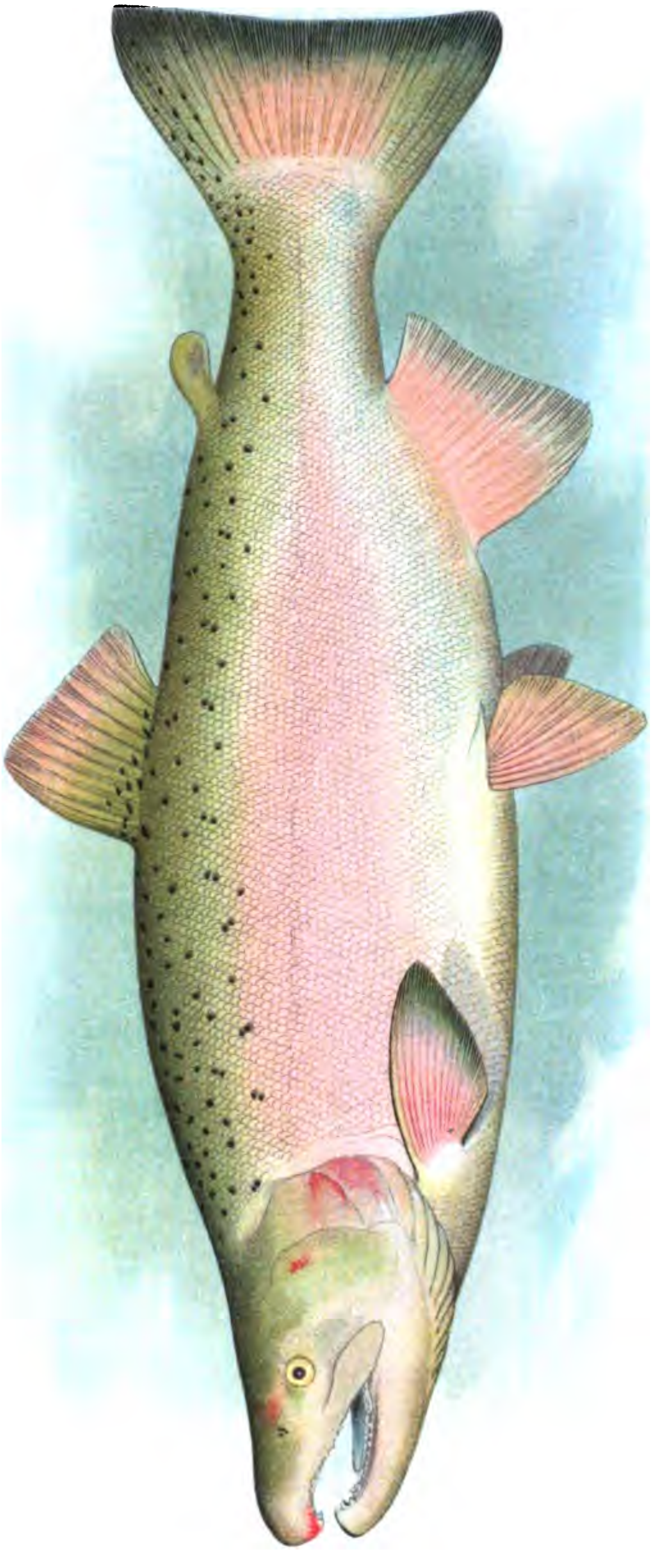

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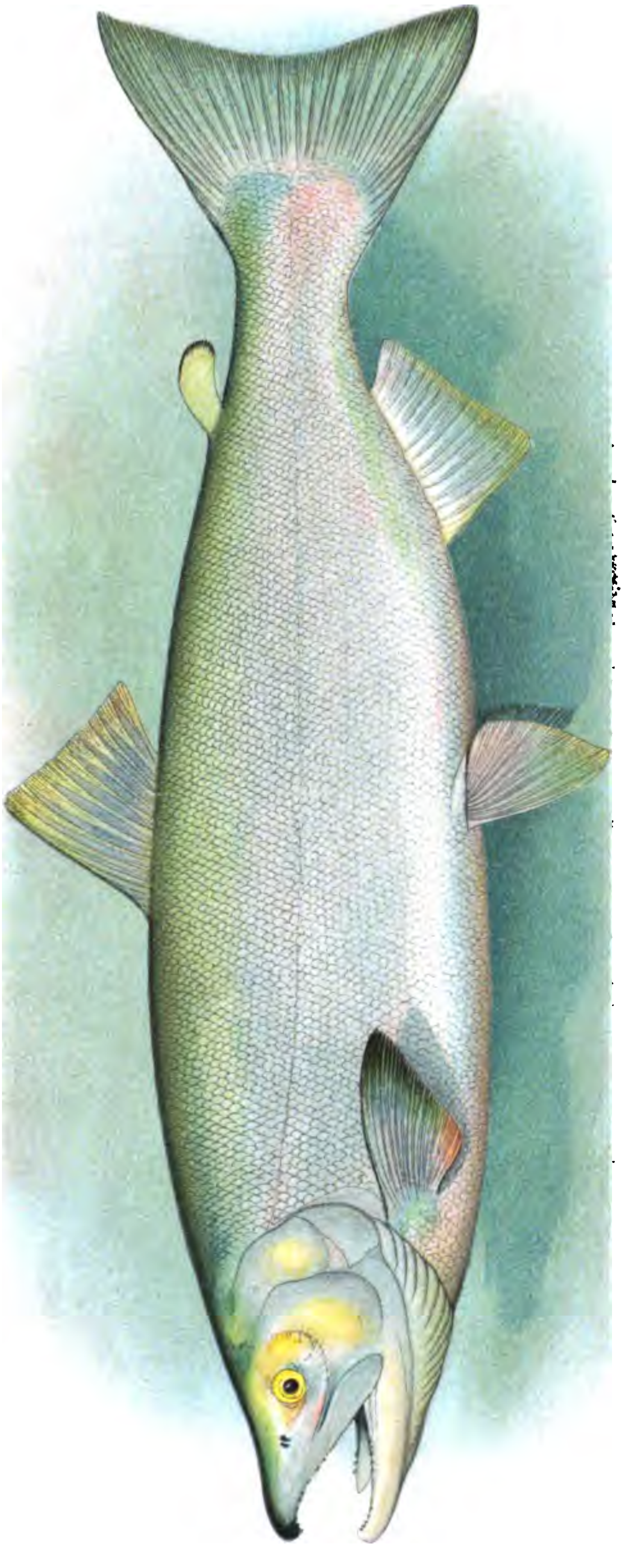

RED SALMON
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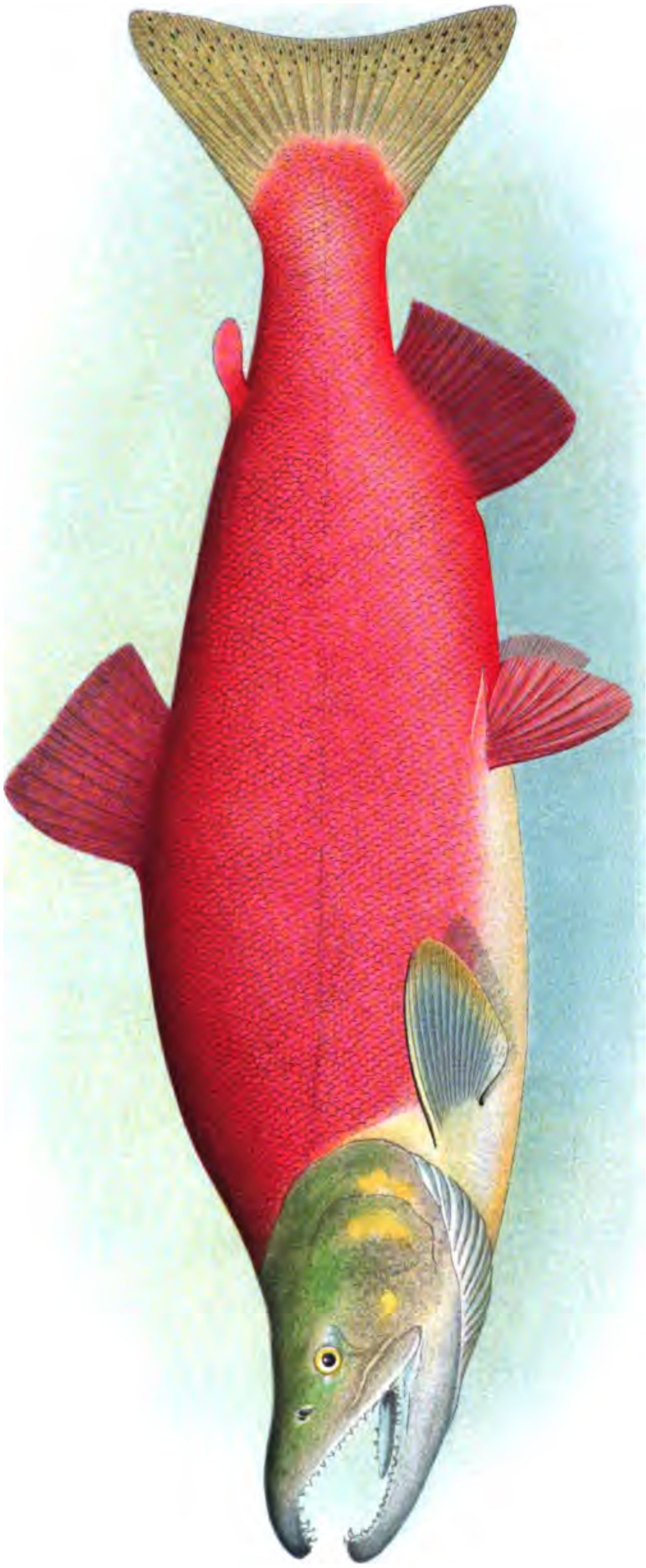

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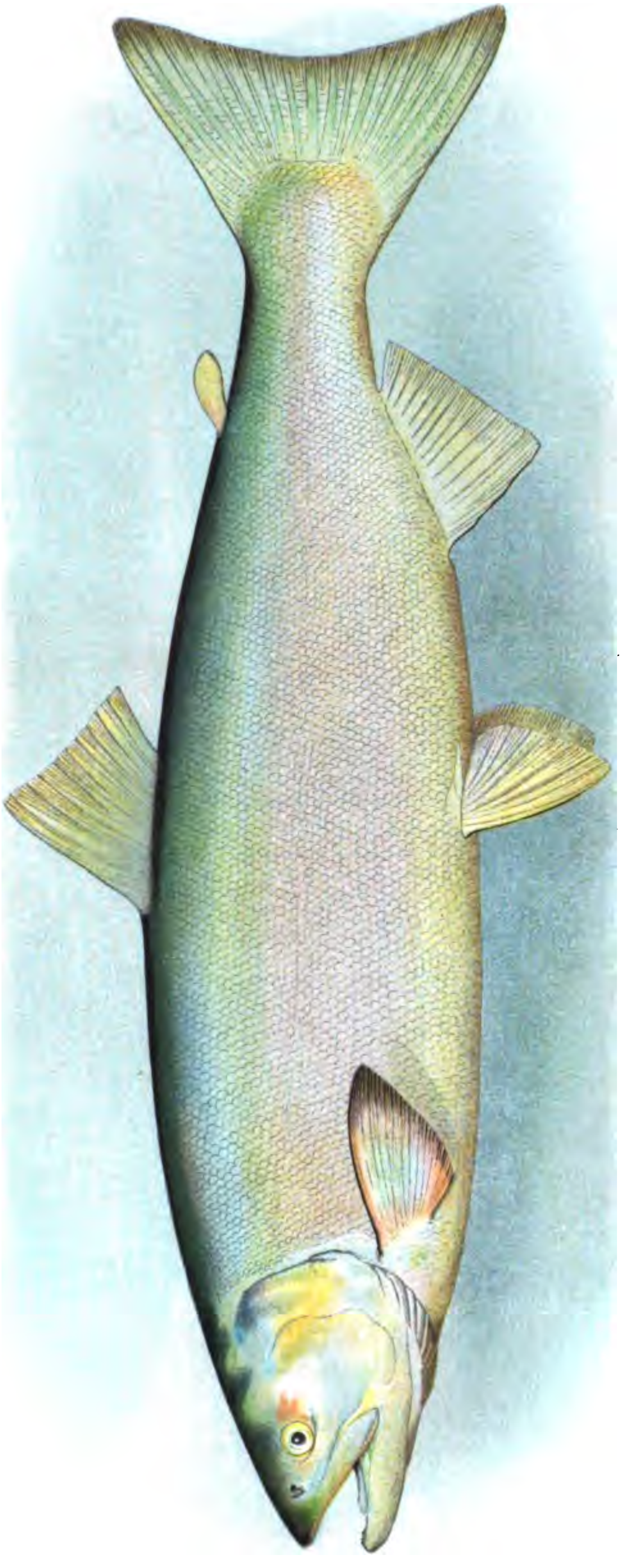

RED SALMON
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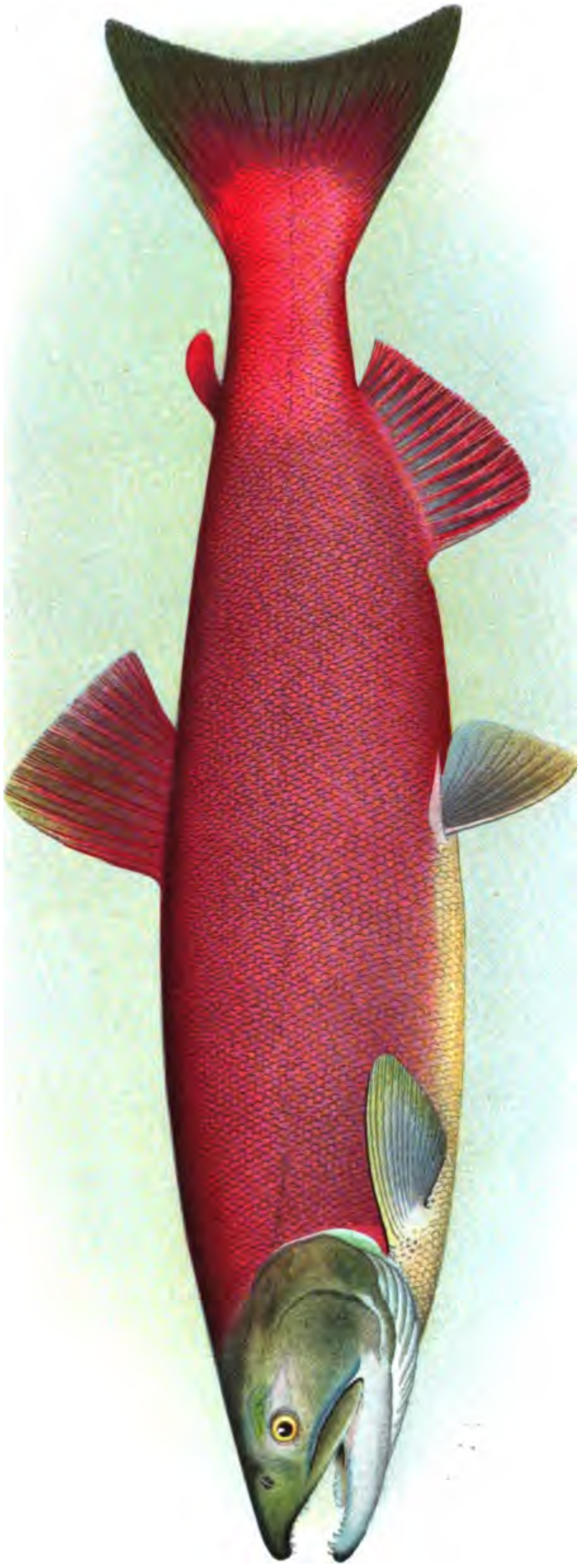

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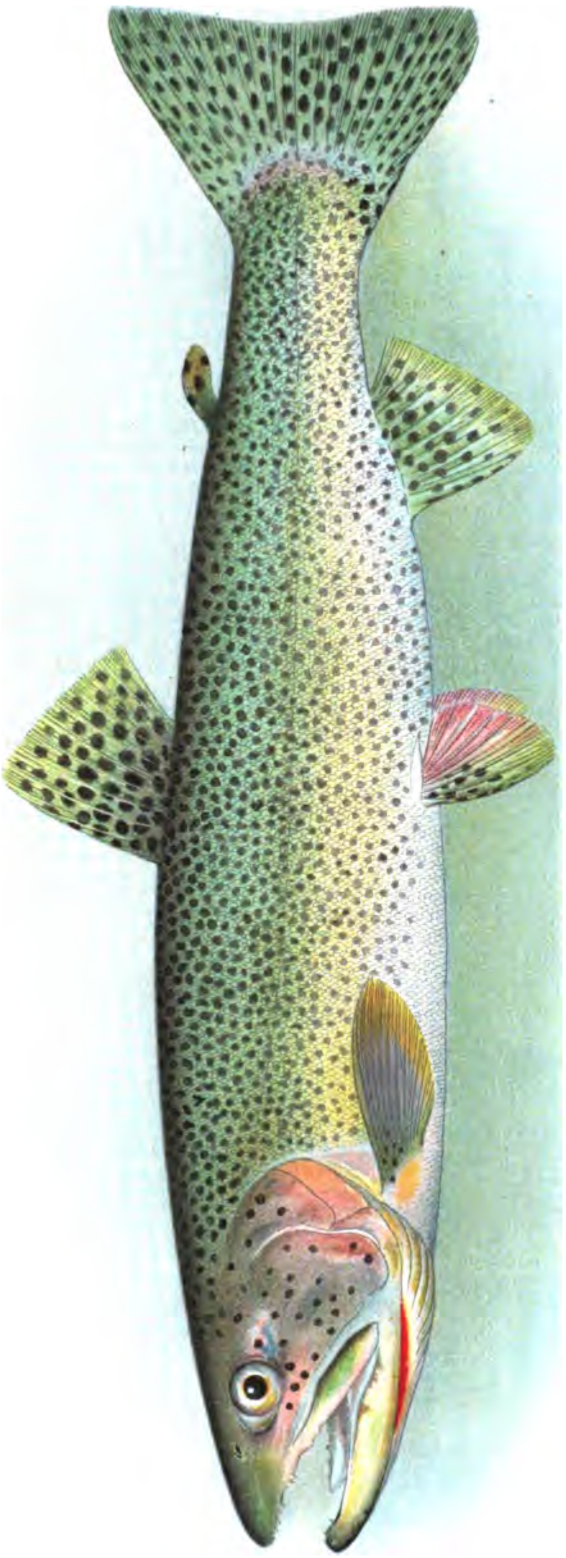

ALASKA CUTTHROAT TROUT
Adult female

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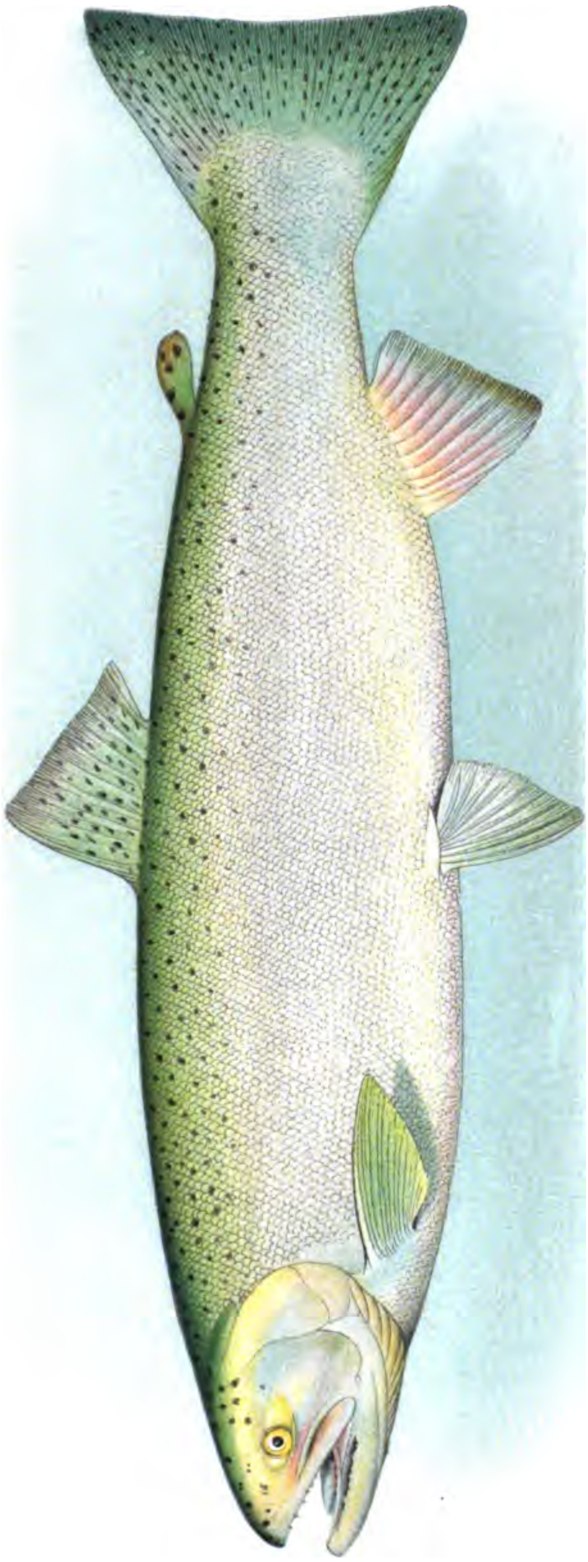

STEELHEAD TROUT

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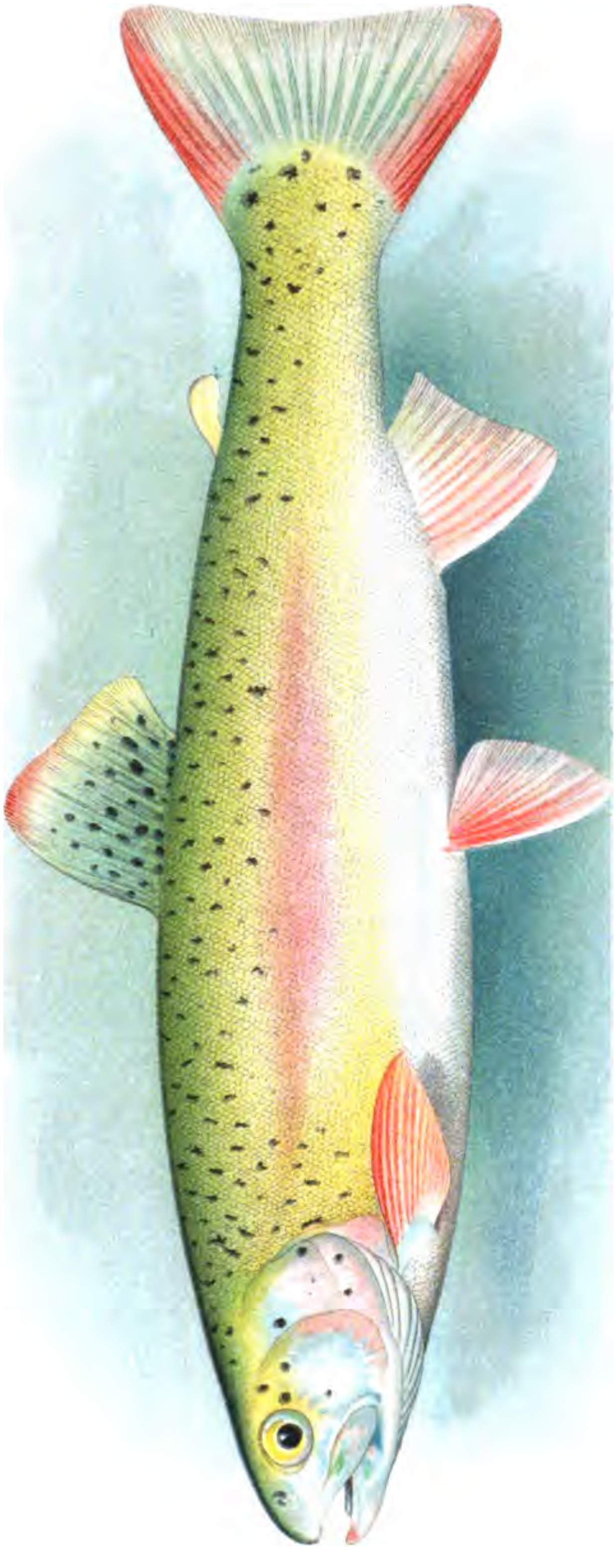

ALASKA RAINBOW TROUT
Adult female

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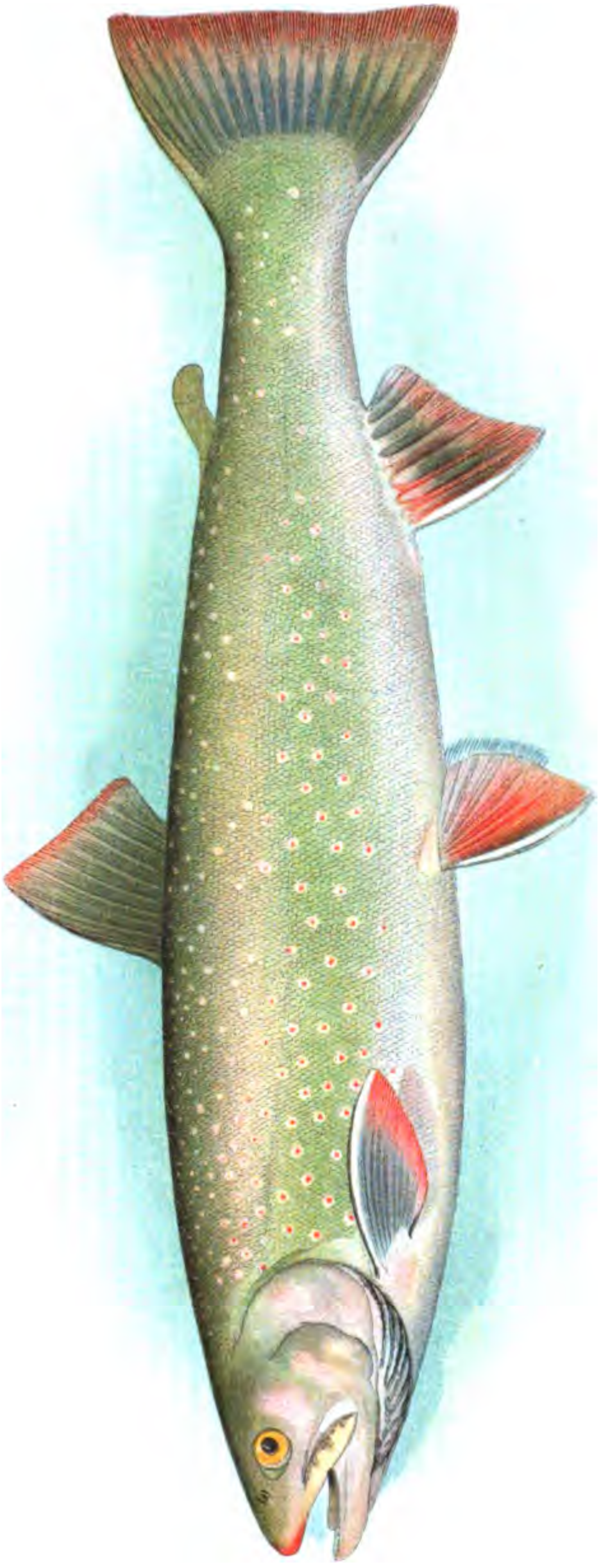

DOLLY VARDEN TROUT
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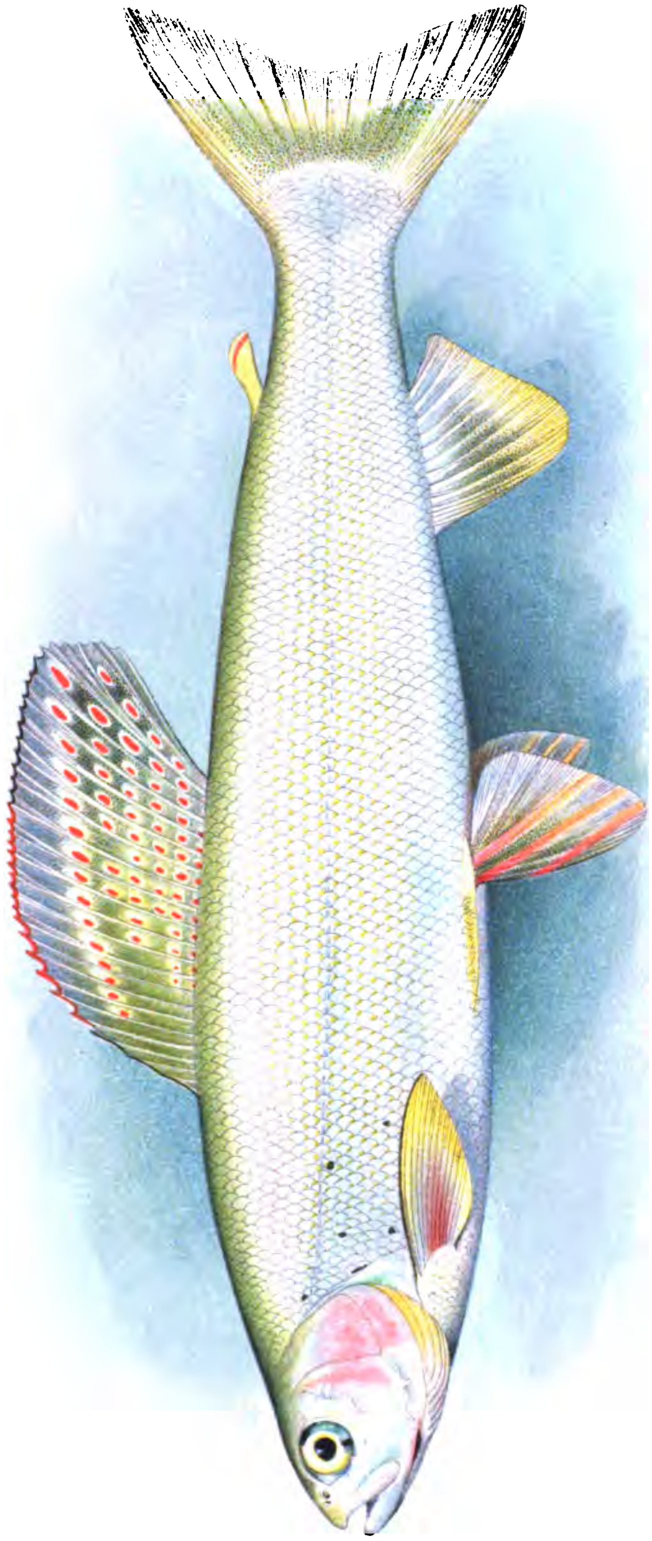

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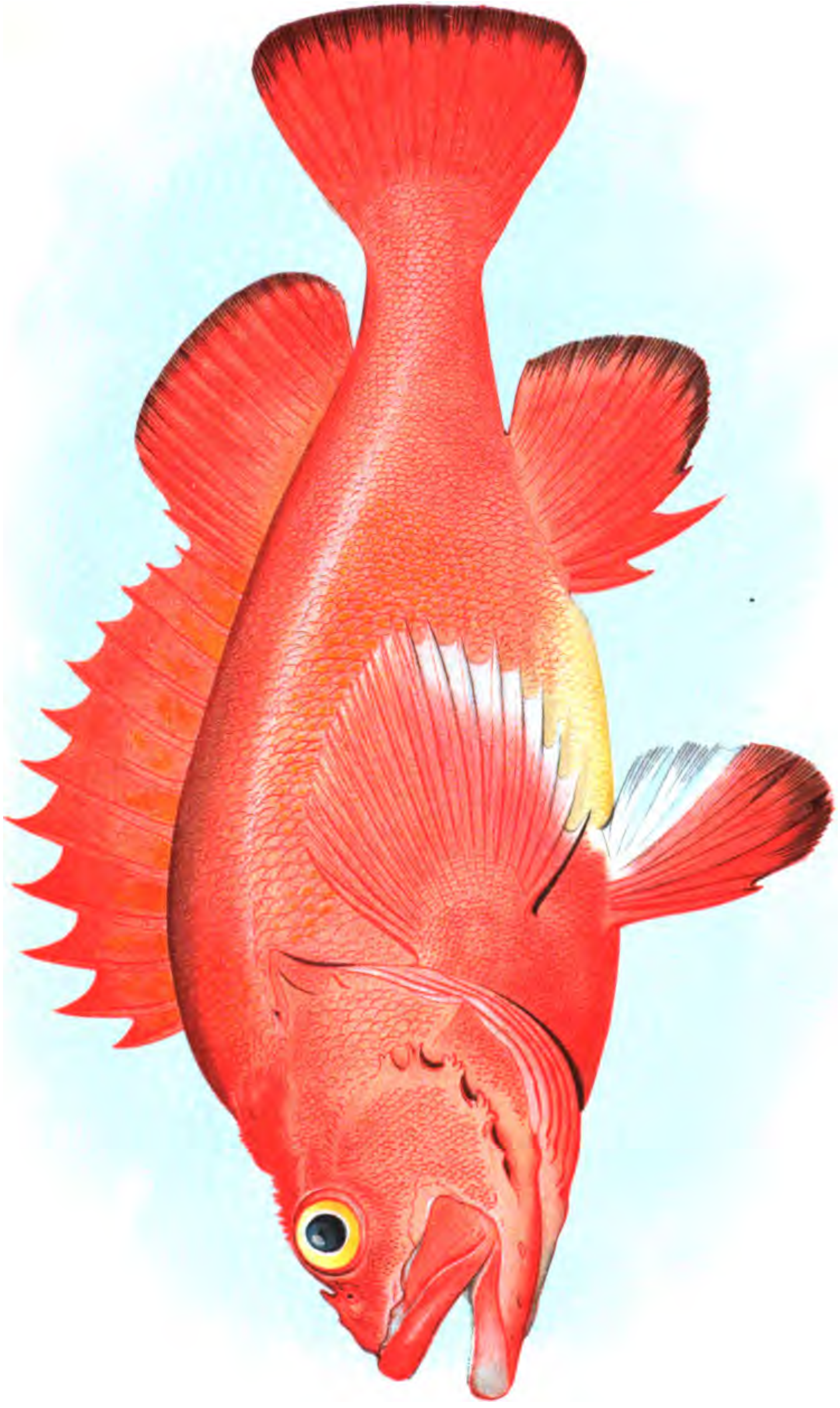

RED ROCKFISH

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